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AMERICAN DYESTUFF REPORTER

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VOLUME 29 JANUARY 8, 1940 NUMBER 1

The Determination of Uronic Acids

in Cellulosic Materials

ROY L. WHISTLER, A. R. MARTIN, and MILTON HARRIS*

ABSTRACT

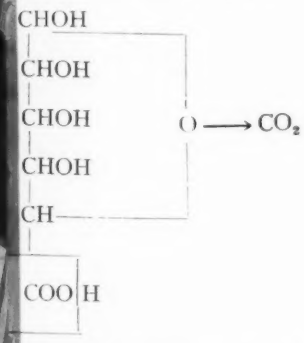
Naturally-occurring cellulosic fibers appear to be a more or less intimate association of cellulose with other constituents, generally referred to as incrusting substances. A portion of these extraneous materials appears to be composed of uronic acids, presumably contained in the pectic substance of the fibers. Many of the important properties of these fibers, such as tensile strength, moisture and dye absorbtion, and viscosity in cuprammonium solution have frequently been considered as related to the presence of small quantities of pectin. In order to study this relationship in greater detail, it was necessary to develop a method for the quantitative estimation of pectin or its constituent uronic acids.

Available methods, based on the evolution of carbon dioxide during treatment of the uronic acid with a boiling solution of hydrochloric acid, were found to fail when cellulose or other carbohydrate materials were present, since these substances also decompose with the evolution of some carbon dioxide. An investigation of the rates of evolution of carbon dioxide showed that pure uronic acids evolved carbon dioxide at a rapid rate and that the evolution of gas was complete in several hours. On the other hand, carbohydrates, free of uronic acids, evolved carbon dioxide at a much slower but approximately constant rate during the entire treatment. It was found that this difference in rates could be utilized for the estimation of uronic acids, even when they are mixed with large proportions of cellulosic materials. A detailed description of the apparatus and its manipulation is given.

I. INTRODUCTION

As part of a program of research related to cotton fiber structure, it was necessary to measure the uronic acid content of cotton, both before and after the application of a variety of treatments. Such analyses necessitated the measurement of small quantities of uronic acids when mixed with large proportions of other carbohydrate material.

Uronic acids in contact with boiling solutions of hydrochloric acid undergo complete decarboxylation.



Proceeding from this observation, Lefevre and Tollens[1] developed a method for the quantitative determination of uronic acids. The decarboxylation of the uronic acid was accomplished by boiling in a solution of hydrochloric acid of specific gravity 1.06. A stream of carbon dioxide-free air, drawn through the apparatus, carried the evolved carbon dioxide from the reaction flask through a reflux condenser into a Peligot tube containing water to remove traces of hydrochloric acid, then through a drying tube, and finally into a weighed potash bulb. This procedure has since undergone numerous modifications[2-11]. The subsequent methods differ for the most part in the manner in which the carbon dioxide is collected and determined, and in the length of time necessary to bring the reaction to completion. The length of time recommended as necessary for complete decarboxylation has ranged from 3½ to 10 hours.

Although these methods gave good results when applied to pure uronic acids, considerable difficulty was encountered when they were used on such materials as cotton fibers or other carbohydrate mixtures. Under the drastic conditions employed in the analysis, it was found that uronic acid-free carbohydrates decomposed with the evolution of carbon dioxide. For example, when pure glucose was treated with a boiling 12-per cent solution of hydrochloric acid, carbon dioxide was continuously evolved; the evolution was appreciable even after 30 hours. A study of the rates of evolution of carbon dioxide revealed that in the case of pure uronic acids there occurred an initial, rapid evolution of carbon dioxide which ceased after several hours. On the other hand, carbohydrates which did not contain

*Research Associates at the National Bureau of Standards, representing the Textile Foundation.

uronic acid groups evolved carbon dioxide at a much slower but approximately constant rate during the entire treatment with acid. A mixture of uronic acids with other carbohydrate material gave an initial rapid evolution of carbon dioxide followed by a slower but steady evolution of the gas.

During the time that the present work was in progress, there appeared three papers[12, 13, 14] from other laboratories, reporting findings relative to the evolution of carbon dioxide from a number of pure sugars and polysaccharides. Norman[13] pointed out that the presence of uronic acid groups could be inferred from the rate of evolution of carbon dioxide (a fact which we had noted independently) and stated that no quantitative significance could be attached to the small yields of carbon dioxide from polysaccharides.

In the present investigation, a critical study was made of the factors which influence the rates of evolution of carbon dioxide from uronic acids, glucose, and cellulose fibers during treatment with hydrochloric acid. As a result of these studies, it has been possible to develop a new method for the precise estimation of small quantities of uronic acids in the presence of cellulosic materials.

II. DESCRIPTION OF APPARATUS AND METHOD

The apparatus which was developed in this investigation is shown in Fig. 1. Two assemblies of the type shown were employed simultaneously; the same source of carrier gas, and the same oil bath was used for both.

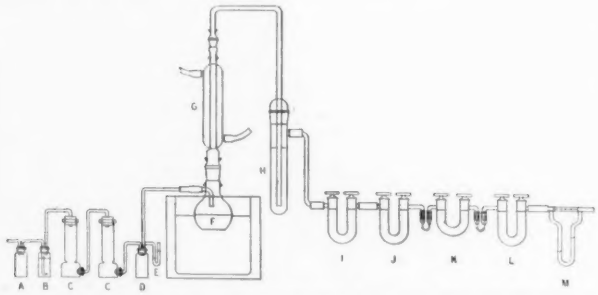


Fig. 1—Apparatus for determination of the rate of evolution of carbon dioxide from uronic acids or materials containing uronic acids during treatment with hydrochloric acid. (The apparatus is not drawn to scale. See text for dimensions.)

Nitrogen, which is used as the carrier gas for the evolved carbon dioxide, enters the apparatus through an empty safety bottle, *A*. It next passes through an alkaline solution of pyrogallol, *B*. The inlet tube in this bottle is drawn out to a small orifice which produces very fine bubbles. From *B* the gas passes through 2 absorption towers, *C*, filled with soda lime, into a second safety bottle, *D*, which is provided with a mercury manometer, *E*, and then enters the reaction flask, *F*, by way of a side arm whose outlet is 10 to 15 mm. above the surface of the liquid in the flask. The size of the flask depends upon the type of material and the size of the sample to be analyzed. In most of the experiments a 500-ml. reaction flask was used. From the reaction flask the gas passes through a 40-cm. reflux condenser, *G*, and into a bubbling tower, *H*, containing approximately 60 ml. of concentrated sulfuric acid. The sulfuric acid serves to remove interfering decomposition products which are carried over from the reaction flask.* The gas next passes through the *U*-tube, *I*, which is filled with anhydrous copper sulfate,† then through the tube, *J*, which contains phosphorus pentoxide, and finally through the carbon dioxide-absorption tube, *K*, containing ascarite, backed by phosphorus pentoxide. The absorption tubes, *K*, are connected into the train by means of mercury-cup seals[15]. This type of connection makes possible a rapid exchange of the absorption tubes. Tube *K* is protected by a soda lime tube, *L*, which is followed by a calibrated flowmeter, *M*, for estimating the rate of flow of nitrogen through the apparatus.

The reaction flask is immersed in a vessel containing about 16 liters of hydrogenated cotton-seed oil. A bath temperature of 130° C. was found to be optimum for maintaining a steady but gentle boiling of the reaction mixture. The bath is brought to the operating temperature by means of 2 electric immersion heaters, one of 500 and one of 1000 watts. When the desired temperature is reached, the 500-watt heater alone is sufficient to maintain thermal constancy within ±0.2° C. The time required to raise the temperature of the bath to 130° C. is approximately 50 minutes.

The sample to be analyzed is placed in the reaction flask *F*. The optimum size of the sample depends on its uronic acid content. When working with a material such as cotton, which contains a relatively small proportion of uronic acids, it is advisable to use samples of approximately 10 gm., although good results may be obtained with smaller samples. A sample of this size is readily covered by 300 ml. of the hydrochloric acid solution. Varying the ratio of acid solution to sample within reasonable limits does not affect the results. Thorough wetting of the sample by the acid solution is accomplished by evacuating the air in the flask with a filter pump.

The flask is placed in position in the oil bath so that the oil level is 3 to 4 mm. lower than the liquid level inside of the flask. This precaution is taken to prevent the baking of small bits of sample which may be splashed against the sides of the flask. Nitrogen, at the rate of about 10 liters per hour is passed through the apparatus until the ascarite tube *K* shows no further gain in weight. This operation requires about 30 minutes, during which time the temperature of the oil bath is slowly raised to 50° C. When the apparatus is free of carbon dioxide, both heating units are turned on and the temperature brought to 130° C. This procedure is always carefully followed in order to assure the same preliminary heating for all

*An aniline-hydrochloric acid mixture may also be used to remove volatile products but in our work was found to be less efficient than H_2SO_4.

†A precaution necessary in systems where chlorine or hydrogen sulfide might be formed.

samples. The point of zero time is taken as the time at which the bath reaches 130° C. At that time the ascarite tube, *K*, is removed for weighing and a second weighed ascarite tube inserted in its place. At the end of one hour, the second tube is removed for weighing and replaced by the first. This process is repeated at intervals of one hour for the duration of the analysis. When analyses are made on pure uronic acids or materials rich in uronic acids, a small amount of carbon dioxide is evolved by the time the temperature of the bath reaches 130° C. In these cases, this amount is measured and added to that evolved during the first hour.

Previous investigators have suggested that the tube entering the reaction flask, *F*, extend into the reaction mixture in order to prevent bumping. However, it was found that there is no tendency to bump when a 12-per cent solution of acid and an oil bath temperature of 130° C. are used. On the other hand, it is found advantageous to have this tube terminate above the surface of the liquid. With this arrangement there is no tendency towards different amounts of agitation resulting from slight variations in the rate of flow of the carrier gas. Furthermore, there is less tendency for the gas stream to carry interfering products from the reaction mixture into the sulfuric acid tower, *H*. That no secondary reaction occurs from the action of sulfuric acid on the volatile substances, which interferes with the determination, was demonstrated by substituting a U-tube cooled in a mixture of solid carbon dioxide and trichloroethylene for the sulfuric acid tower, *H*. Identical results were obtained under both conditions.

The length of time required to sweep the carbon dioxide from the reaction flask into the absorption tubes was determined by the use of a known quantity of pure sodium carbonate. The sample was weighed in a glass tube, and the ends were sealed with paraffin. The tube was placed in an acid solution in the reaction flask and the train swept out with nitrogen. The temperature of the bath was then raised until the paraffin plugs loosened and allowed the acid to come in contact with the sample of carbonate. Since the reaction is extremely rapid, it was easy to determine the moment at which the carbon dioxide was released into the system. This procedure was repeated several times, a different rate of nitrogen flow being used in each case. It was found that with a gas flow of 10 liters per hour, all of the carbon dioxide was absorbed by the ascarite in less than 30 minutes.

III. EXPERIMENTAL RESULTS AND DISCUSSION

The rate of evolution of carbon dioxide from pure galacturonic acid monohydrate in 11-, 12-, and 13-per cent solutions* of hydrochloric acid is shown in Fig. 2. The curves show that an initial, rapid evolution of carbon dioxide occurs and that the evolution ceases after about 4 hours. A total of 208 mg. of carbon dioxide per gram of galacturonic acid monohydrate was obtained (the theoretical yield is 207.5 mg.). Increasing the concentration of acid increases the rate of evolution but does not affect the total amount of gas evolved.

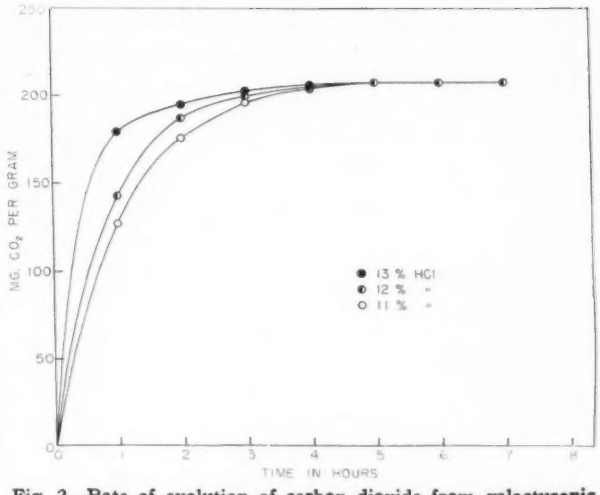


Fig. 2—Rate of evolution of carbon dioxide from galacturonic acid monohydrate.

Similar treatment of pure glucose in solutions of hydrochloric acid gives very different results, as shown in Fig. 3. The amounts of carbon dioxide evolved are small† compared with the amounts obtained from galacturonic acid under similar conditions. The rate of evolution increases with increasing acid concentration, but unlike the case of the galacturonic acid, the evolution of gas continues, except in the most concentrated acid solutions, at an approximately constant rate for the duration of the analysis.

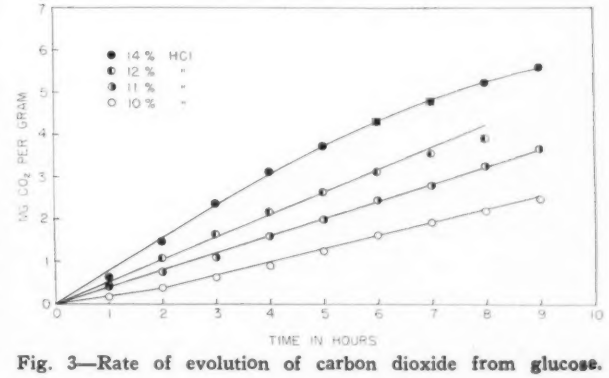


Fig. 3—Rate of evolution of carbon dioxide from glucose.

The amount of carbon dioxide obtained from pure glucose is very small compared with that obtained from pure galacturonic acid, but it is obvious that in naturally-occurring cellulosic materials such as cotton, which contain only small amounts of uronic acids, the amount of carbon dioxide evolved by that portion of the material which does not contain uronic acid groups may be an appreciable part of the total. This is shown by the curves for dewaxed

*These solutions contained 110, 120 and 130 g. of hydrogen chloride per liter of solution.

†Because of the small amount of CO_2 evolved, 10-g. samples of glucose were used for each analysis.

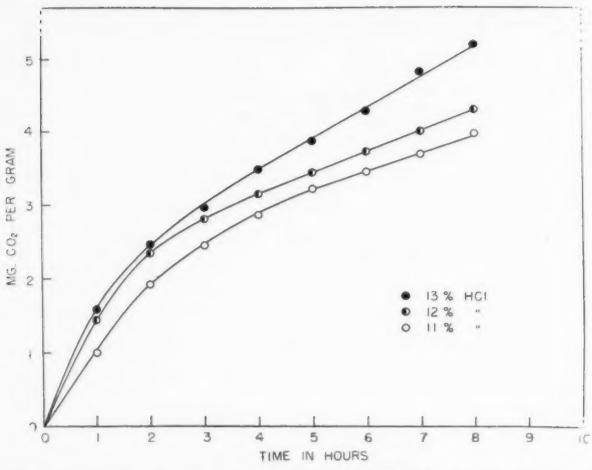


Fig. 4—Rate of evolution of carbon dioxide from dewaxed cotton.

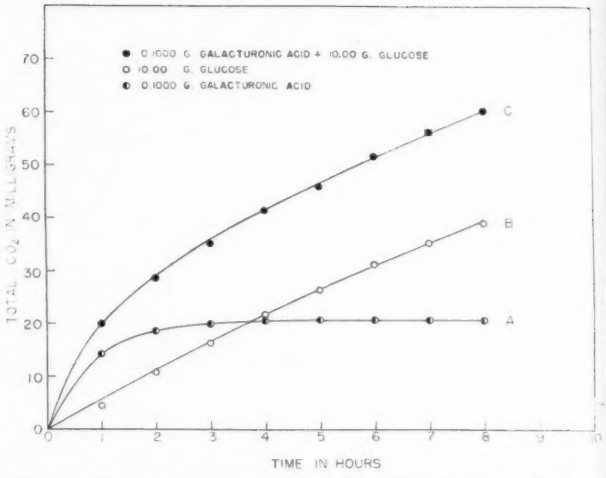


Fig. 5—Rate of evolution of carbon dioxide from glucose, galacturonic acid, and a mixture of both.

cotton* in Fig. 4. An examination of these curves indicates that they are probably composites of curves of the types found in Figs. 2 and 3. The rapid evolution of carbon dioxide during the first 3 hours, as indicated by the steep slopes of the curves, is characteristic of uronic acids. After the 3-hour period the evolution of gas does not cease but continues at a slower but constant rate characteristic of carbohydrates which do not contain uronic acid groups. As in the previous experiments, the rate of evolution of gas increases with increasing acid concentrations.

On the basis of the results shown in Figs. 2, 3, and 4, a 12-per cent solution (3.290 *N*) of hydrochloric acid was chosen as of a satisfactory concentration for the decarboxylation of uronic acids in the presence of other carbohydrate materials.† In lower concentrations of acid, the decarboxylation of the uronic acids proceeds too slowly for convenience while in acids of higher concentration, the decomposition of the carbohydrate itself is too rapid and erratic. *Since the rate of evolution of carbon dioxide is appreciably affected by variations in acid strength, it is essential that the same concentration (within 0.02 per cent) of acid be used in all comparative studies.*

That the results obtained with dewaxed cotton probably represent the behavior of a mixture of uronic acids and other carbohydrate materials was further indicated by studying the evolution of carbon dioxide from glucose, galacturonic acid and a known mixture of the two. The results are shown in Fig. 5. Curve *C*, which represents the total amount of carbon dioxide evolved from a mixture of 10.00 g. of glucose and 0.100 g. of galacturonic acid monohydrate, is similar in shape in the curves in Fig. 4. The total amount of carbon dioxide evolved by the mixture at any time, as shown by curve *C*, is equal to the sum of the amounts evolved by each of the components in the same time, as shown by curves *A* and *B*. The good agreement of the data is seen in Table 1.

TABLE 1
Evolution of Carbon Dioxide from Galacturonic Acid, Glucose, and a Mixture of Both

Time	1 0.100 *g.* *Galacturonic Acid* *(Monohydrate)*	2 10.00 *g.* *Glucose*	3 1 + 2 *Calc.*	4 1 + 2 *Found*
Hrs.	*mg.*	*mg.*	*mg.*	*mg.*
1	14.3	4.5	18.8	20.0
2	18.7	10.8	29.5	28.7
3	20.0	16.4	36.4	35.2
4	20.6	21.8	42.4	41.5
5	20.8	26.4	47.2	46.0
6	20.8	31.3	52.1	51.7
7	20.8	35.4	56.2	56.3
8	20.8	39.1	59.9	60.3

Conversely, it follows that, the amount of carbon dioxide evolved from uronic acid groups in this or similar mixtures can be readily estimated from the differences between the ordinates of the parallel portions of the curves *B* and *C*. The average of these differences, taken from the data in Table 1, is 20.5 mg. of carbon dioxide (theory, 20.75 mg.).

The curves shown in Fig. 6 were obtained from samples of dewaxed cotton and from cotton which had been purified by boiling for 7½ hours in a 1-per cent solution of sodium hydroxide according to the methods recommended for the preparation of standard cotton cellulose[16, 17, 18]. With the exception of the induction period during the first 2 hours, the curve for purified cotton is similar in shape to that for glucose. It shows no initial, rapid rise, characteristic of the uronic acids, and indicates that cotton purified in this manner is free from a measurable amount of uronic acids. The amount of carbon dioxide evolved from the uronic groups in the dewaxed cotton is obtained by taking the average distance between the parallel por-

*Dewaxed cotton refers to cotton which has undergone 24-hour extractions each with alcohol and with diethyl ether.

†This concentration was used in all subsequent experiments.

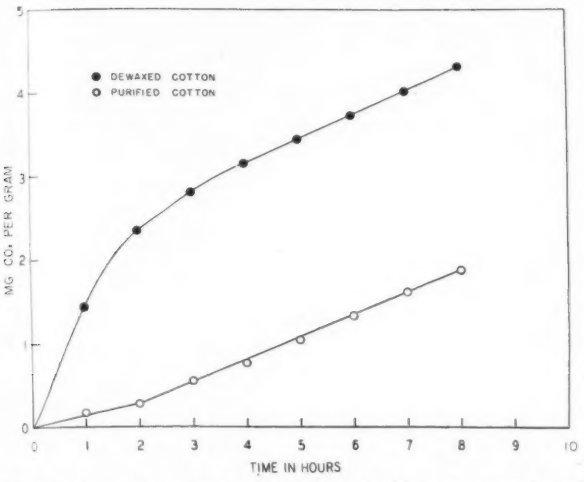


Fig. 6—Rate of evolution of carbon dioxide from samples of dewaxed and purified cotton.

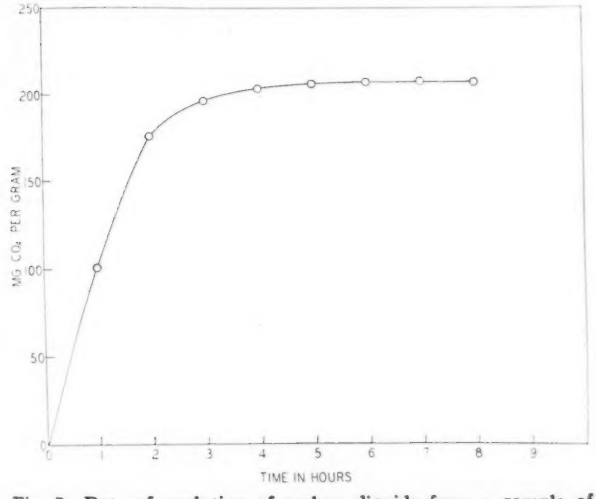


Fig. 7—Rate of evolution of carbon dioxide from a sample of pectin from cotton.

tions of the curves, which gives a value of 2.4 mg. of carbon dioxide per gram of cotton.

It has generally been assumed that the uronic acids in native cotton are contained in the pectic* substance of the fiber. Further evidence for this assumption is shown in Fig. 7. The carbon dioxide-rate curve of the pectin† is very similar in shape to that obtained for galacturonic acid (Fig. 2), and reaches a maximum at 208 mg. of carbon dioxide per gram of pectin. From this value, a factor of 4.8** for converting carbon dioxide, formed from uronic acids, to the pectin extracted from cotton, is obtained. The pectin content of the cotton used in the present work may then be roughly estimated by multiplying 2.4 mg. (from the curves in Fig. 6) by 4.8, which gives a value of 11.5 mg. of pectin per gram or 1.15 per cent. As it is to be expected, this value is higher than previously reported values obtained by isolation methods[20, 21].

The uronic acid contents of a number of other cellulosic fibers were also determined. Table 2 shows the results obtained from decorticated ramie, retted flax, and purified samples of both. Purification was accomplished by treatment of the fibers with a boiling, 1-per cent solution of sodium hydroxide for 4 hours by the methods described for cellulose. The data for the decorticated ramie and retted flax are similar to those obtained for dewaxed cotton, inasmuch as they show an initial, rapid evolution of carbon dioxide, which becomes slower but approximately constant after 4 hours. During the first 4 hours considerably more carbon dioxide was evolved by both ramie and flax than was evolved in the same period by cotton. The value for the amount of carbon dioxide evolved by the uronic acid groups, obtained by subtracting the value for the purified from that for the unpurified fiber, reaches a maximum after about 4 hours and then remains constant. An average of 10.4 and 10.2 mg. of carbon dioxide per gram of ramie and flax, respectively, was obtained.

*Pectic substance has been defined by the A.C.S. committee on nomenclature of pectin[19] as a complex carbohydrate derivative which is characterized by the presence of galacturonic acid units.

†The pectin used in these experiments was obtained from the cotton by the well-known method of extraction with ammonium oxalate. A description of the preparation and properties of this pectin is being prepared for publication.

**This factor is valid only if it is assumed that the pectin has not been appreciably altered during removal from the fiber. Justification for the use of such a factor will depend on obtaining similar results on samples of pectin removed from cotton by several different methods. Work along this line is in progress.

TABLE 2

The Amount of Carbon Dioxide Evolved from the Uronic Acid Groups of Ramie and Flax Fibers

Duration of Treatment	*RAMIE*			*FLAX*		
	Decorticated	*Purified*	*Uronic Acid-Carbon Dioxide*	*Retted*	*Purified*	*Uronic Acid Carbon Dioxide*
Hrs.	*mg./gm.*	*mg./gm.*	*mg./gm.*	*mg./gm.*	*mg./gm.*	*mg./gm.*
1	5.4	0.3	5.1	5.4	0.3	5.1
2	8.5	.5	8.0	8.7	.7	8.0
3	10.1	.6	9.5	10.2	1.0	9.1
4	10.9	.7	10.2	11.2	1.4	9.8
5	11.4	1.0	10.3	11.7	1.6	10.1
6	11.9	1.4	10.5	12.2	1.9	10.3
7	12.0	1.7	10.3	12.5	2.3	10.2
8	12.4	2.0	10.4	12.8	2.6	10.2
9	12.7	2.3	10.4	13.1	3.0	10.1

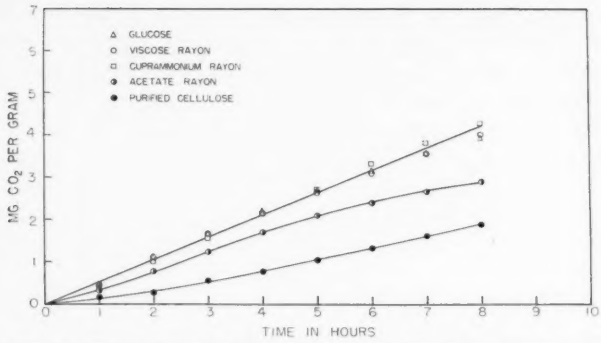


Fig. 8—Rate of evolution of carbon dioxide from samples of rayon, glucose and purified cotton.

The results obtained from three different samples of rayon are shown in Fig. 8. The curves for viscose and cuprammonium rayon are nearly identical with that for glucose. A sample of acetate rayon evolved carbon dioxide at a somewhat lower rate. However, if the data for the acetate rayon are calculated on the basis of milligrams of carbon dioxide per gram of cellulose instead of cellulose acetate, the results are very similar to those for the viscose or cuprammonium rayon. The curves for these samples indicate that they are free of uronic acids.

A carbon dioxide-rate curve for purified cotton cellulose is included for comparison. It is of interest to note that the slope of this curve is quite different from that of glucose or the regenerated fibers.

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Important Chemical Developments

in the Textile Industry*

E. W. K. SCHWARZ**

TEXTILE progress more than ever is chemical progress, and our textile industry is profiting ever more by research carried on by the chemical industry. As a matter of fact, the chemical industry is responsible for the most radical change that has ever been heralded in the textile industry. I do not want to bore you with reciting a long list of inventions and patents or processes, new dyestuffs, finishes, or machines. What I propose to do is to paint for you a picture of the fundamental progress that has taken place in recent years—a picture that you can have before you as a whole rather than in part. To talk about textile progress today is—with some exceptions of course—equivalent to considering in a broad sense progress in new textile materials and their application. You, as textile technologists, are mainly interested in materials which are suitable for textile fibers and how these textile fibers can be made adaptable to making fabrics of all sorts, especially how to evolve novel effects, new textures, and improved qualities. Allow me a few seconds for creating the background for our picture.

There are three distinct phases or eras into which the history of the textile industry may be divided. These are:

First—The era of selecting, using and adapting the available natural fibers.

Second—The era of utilizing the basic materials of which the natural fibers are composed in order to produce artificial or man-made fibers. These basic materials are

*Presented at meeting, American Association of Textile Technologists, December 6, 1939.

**Consulting Textile Chemist.

cellulose in case of vegetable fibers and protein substances in case of animal fibers. Perhaps this era could be called the era of *"converted fibers."*

Third—The era of producing synthetically new types of raw materials from which textile fibers can be made. These new materials, incidentally, are suitable for making other products such as sheets, bristles, artificial hairs and so forth, the same as can be made from cellulose and protein materials.

PROPERTIES OF TEXTILE FIBERS

For a material or a fiber to be suitable as a textile fiber certain properties are necessary. These properties may be divided roughly into two categories, namely:

A—Fundamental or primary properties.

B—Contributory or secondary properties.

It is within this framework of primary and secondary properties, that we can paint the picture of textile progress of recent years. Let us briefly review these properties:

A—Primary Properties

1—Form.
2—Strength.
3—Suppleness or flexibility.
4—Stability to physical and chemical action.

B—Secondary Properties

1—Resilience.
2.—Elasticity.
3—Hygroscopicity (moisture absorption).
4—Crimp.
5—Shape (cross-sectional).
6—Luster.
7—Affinity (for dyes, finishes, etc.).
8—Their ability to react with or resistance to chemicals.

It is these two last properties around which all the processes of dyeing, printing, finishing, mercerizing, etc., revolve. I shall not follow this order of properties rigidly in describing the latest developments but for the sake of expedience I will have to jumble them a bit and do it in a "wrong way Corrigan" manner. To this end, I will consider the secondary properties first and the primary ones last. This is the way the textile processing industry approached its problems, because little if anything was known about the properties of the materials of which the fibers are composed.

Let us first consider the affinity of fibers for dyes or chemicals. Up to relatively recent years we were entirely dependent upon the natural affinity of fibers (natural as well as artificial) if we wanted to dye or print them. We had to make dyes to suit the fibers. As we learned more about the nature of the fibers, however, we were able to change this affinity of the various fibers at will and so we made cotton take acid colors, which up to then, could only be used on wool or silk, or we could treat cotton in a way so as to become immune to direct dyes, hence the name "immunized cotton." We could not, however, make use of a class of dyestuffs which possesses very remarkable fastness and other properties, namely, certain pigments. I am not referring here to organic pigments such as alizarine or vat dyestuffs, but to true insoluble pigments such as are used for paper printing. There has been a most remarkable development in this class of dyes in recent years, which in turn had a decisive influence upon a newly developed process for printing of textiles. I have in mind a new class of pigments, called phthalocyanines and sold under the name of Monastral colors. The new printing process, which now is becoming a new dyeing as well as a finishing process, is the Aridye process, which you all know. The phthalocyanines were discovered by accident, as so many things have been. They were first observed as an impurity (and a very embarrassing one) during the purifying process of commercial phthalimide. This impurity was of a dark blue color and proved to contain iron from the iron vessel in which the process was carried out. Other similar compounds were prepared from copper, nickel and other metals and this led ultimately to the discovery of a new class of insoluble pigments — the phthalocyanines. They are all green to blue, there are no reds or yellows. They have an extreme intensity and beauty of color and are exceedingly fast to light, water, chemicals and even to heat. As a matter of fact, they are faster than anything in color, produced so far. They sublime chemically unchanged at 550° C. Due to their insolubility they were used first for coloring paper and plastics. Later on, they were used for dyeing rayons (viscose and acetates) in the mass and we have now halogenated and sulfonated phthalocyanines for dyeing textiles. These products possess the same fastness properties as the original insoluble pigments. These insoluble pigments, however, have lately found a wide field of application in a coloring process developed by a subsidiary of the Interchemical Corporation, which makes use of new knowledge gained in the field of resins and solvents. This is the so-called Aridye process. The idea of coloring textiles with the aid of suitable solvents and resins is not at all new. As a matter of fact, big chemical companies such as the I. G. have been working on this idea for many years. But it remained for American research to solve this problem in a practical way, because it was here that new solvents, as well as new resins, were available which together with the great experience in paper printing and colloidal phenomena made this development possible. Textile printing as compared to modern high-speed paper printing is very slow indeed—only about one-tenth as fast. Also, paper printing is more highly developed as far as fidelity of reproduction, shading and color effects are concerned. The fundamental factors as relating to rotogravure paper printing and textile printing are essentially the same. Cylinders for paper printing are shallow, those for printing of fabrics are mostly deeply engraved. This fact is due to the coloring medium, which is the fundamental difference between these two kinds of printing processes. This medium is the "printing paste" for textile printing, for paper printing this medium is the "printing ink." The printing paste is generally made with water soluble gums or starches which form a so-called

pseudo-plastic medium. This requires a deep engraving. The printing ink, on the other hand, is an organic solvent solution of resins or resinous materials in which pigments have been dispersed. Their physical characteristics make possible printing of fine engraving at high speed. The most difficult problem at the outset was not to produce a continuous film of resin upon the fabric. The tendency of the resin solution to form a film and cause stiffness of the fabric had to be solved. The rapid advance of knowledge in the field of synthetic resins made it possible to obtain such resins which combine with cellulose to such a degree to make the resin virtually a part of the fiber. This has nothing to do with chemical affinity, it is purely physical. This problem of printing with pigments could not have been solved without new aspects in the science of dispersion. The physics of dispersing insoluble pigments into resins so that each minute particle of color pigment is colloidally surrounded by resin is tremendously involved. This is a science by itself and it helped materially in solving the problem of avoiding the formation of continuous films, of improving penetration, of adhesion, of crocking, etc. Today this process is used by a great number of big textile printers and is a big business. It is interesting to note, that this process is now being carried over into the dyeing of textiles. That is to say, that fabrics are now printed with a solid roll (not engraved) so that the whole fabric is actually printed in one solid shade. At the same time, a semi-permanent or even permanent finish can be applied. The possibilities of this new type of printing or dyeing of fabrics are indeed vast and might well lead to another revolution in dyeing and finishing of fabrics. Many problems, which the dyer had to face, such as unevenness, streakiness, hard water, etc., are at once eliminated.

Since we are discussing synthetic resins it is in order to recall to you the interesting paper by Dr. Powers delivered last summer. In this paper, Dr. Powers told us about the use of various synthetic resins, especially of the urea-formaldehyde type to produce such interesting effects as non-crushability of cotton and rayon fabrics, effects which in most cases are permanent. Here we have another example of how we can modify and improve some of the properties of our textile fibers, in this case, resilience—or rather—the lack of it. The remarkable thing about these resins is that they can be brought within the fiber while still soluble and then by a curing process are converted into an insoluble resin. Although this resin is itself very brittle, it does not change the flexibility of the fiber. Even in small quantities it gives quite a full hand to many rayon or cotton fabrics. When deposited on the outside of the fiber, it makes fabrics slip-proof. It is not necessary here to elaborate on this subject of resin finishes except to say that now resins of this type are available in organic solvent emulsions which can be applied to fabrics as water emulsions and need no curing at high temperature.

But there is another use or possible use of the urea-formaldehyde condensation on dyes, which seems to have been overlooked or forgotten. Often, direct dyeings on cotton or rayon aftertreated with these resins are faster to light, washing and rubbing than the regular dyeing itself. This should be taken advantage of more than it is at present, especially with the new class of dyestuffs, which are not affected by formaldehyde. There is a patent hiding in the vast patent literature which utilizes this fact. It comprises printing of silk with lamp-black and di-methylol-urea. This print is absolutely fast to light, washing, water and crocking. These processes deserve undoubtedly more attention than they receive at present.

Synthetic resins are playing an ever increasing role in textile processes. Many new and different types of resins are constantly being introduced. For instance, the so-called alkyd or modified alkyd resins are being used for various effects, such as slip-reducing finishes, also as substitutes for older types of finishes. Some of them may be used in connection with starch such as a thermoplastic resin called Textac, made by the Hercules Powder Company. This resin acts as a binder for the starch, prevents dusting off and makes the back-filling or finish more permanent. It also makes softeners practically unnecessary and allows more filling to be used. Of course, many other resins are being used and experimented with, such as the methacrylates or polyvinyl resins, but they have not as yet achieved great commercial importance for textile purposes.

There is one more point I should like to mention about the use of resins, although it has only indirectly to do with textiles. But it serves to illustrate the possibilities of resins for uses which might have seemed far fetched sometime ago. You are all familiar with the importance which water serves in the processing of textiles. You also know that hard water can create many difficulties for the dyer and finisher. The reason for that is that the so-called hardness formers, mainly calcium and magnesium ions combine with the fatty acids in soap and vegetable oils to form insoluble metallic soaps. These are difficult to remove and cause all sorts of difficulties in dyeing and finishing. One of the most widely used systems of removing the hardness formers from water, works according to the so-called "exchange principle." This means that the sodium base of the softener is exchanged for the calcium and magnesium in the water. So instead of forming insoluble metallic soaps the soluble sodium soaps are formed. This exchange takes place while the water passes through a layer of Zeolite or Permutite in a tank. Zeolites or Permutites are naturally mined silicates or based upon natural compounds. In recent years, a new class of suitable synthetic exchange compounds have been discovered. These are on the one side condensation products of aromatic compounds of basic character, especially polyvalent phenols or natural tanning compounds with formaldehyde. These types of resins are suitable for exchanging cations. On the other hand, it has been found that condensation products of amines (mostly aromatic amines) with aldehydes are suitable for anionic exchange. The fundamental difference between the known types of synthetic resins and these

(Continued on Page 19)

PROCEEDINGS OF THE

American Association of Textile Chemists and Colorists

JANUARY 8, 1940

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Members should notify the **Secretary** immediately of all address changes

• CALENDAR • OF COMING EVENTS

Mid-West Section announces that the second of a new series of educational lectures on subjects relating to textile processing will be given on January 12, 1940. The speaker is Dr. Malcolm Dole, Northwestern University, on "Theory of Dyeing." The meeting will be held at the lecture hall of the Chicago Lighting Institute in the Civic Opera Building, 36th Floor, 20 North Wacker Drive, Chicago, at 8 P.M. All persons interested are invited to attend. These lectures are free.

Meeting, Philadelphia Section, Penn A. C., January 19, 1940.

Meeting, New York Section, Swiss Chalet, Rochelle Park, N. J., January 26, 1940.

Annual Meeting, Mid-West Section, Sherman Hotel, Chicago, Ill., February 10, 1940.

Annual Meeting and Convention, auspices New York Section, October 18th and 19th, 1940, Hotel Commodore, New York City.

MEETING TO ORGANIZE EXTENSION COURSES IN TEXTILE CHEMISTRY, DYEING AND FINISHING IN THE SOUTH

UPON invitation of Professor A. H. Grimshaw of North Carolina State College, R. H. Souther of Proximity Print Works, R. H. Tuttle of Karastan Rug Mills, and F. A. Whitney of Granite Finishing Co., met recently with Professor Grimshaw to discuss organization of special courses in dyeing, finishing and textile chemistry for employed mill workers, supplementing courses in cotton carding, spinning and weaving already offered in ten states. This note of the meeting is published in the hope that other Southern members of the American Association of Textile Chemists and Colorists will send suggestions to Professor Grimshaw.

ONE HUNDRED AND EIGHTEENTH MEETING OF THE RESEARCH COMMITTEE

THE 118th meeting of the Research Committee followed the Council meeting in New York on Friday afternoon, Nov. 17, 1939. Present were Chairman Louis A. Olney presiding, W. D. Appel, K. H. Barnard, G. L. Baxter, J. R. Bonnar, W. H. Cady, C. Z. Draves, E. Freedman, W. R. Moorhouse, G. A. Moran, R. E. Rose, B. A. Ryberg, W. M. Scott, C. A. Seibert, H. W. Stiegler, A. R. Thompson, Jr., H. S. Travis, W. S. Williams, and H. C. Chapin, Secretary.

The Chairman presented a general report. Mr. Appel reported for the Light Fastness Committee, starting an extended discussion of electric arc fading machines, relative merits of different machines and electrodes, and possible methods of improving and standardizing. Reporting for the Committee on Crease Resistance and Permanence of Finish on Fabrics, Mr. Barnard discussed the Drape Meter being developed for the Association by Professor Schwarz of the Massachusetts Institute of Technology. Mr. Appel described an instrument of different principle being developed at the National Bureau of Standards for measuring differences in surface texture. Mr. Bonnar, reporting for the new Committee on Transference of Color, outlined its plan. Mr. Ryberg reported the results of a questionnaire on perspiration fastness tests, and another on possible need of wash fastness tests for rayon. There was considerable debate on the perspiration tests. Mr. Cady was appointed Chairman of a committee to develop tests for susceptibility of dyed acetate rayon to gas fading. There was brief discussion of analytical methods of separating wool and cotton, in which Mr. Freedman stated that he had abandoned the aluminum chloride method because of corrosion of laboratory equipment.

Mr. E. M. Edgerton and Mr. J. A. Mellor were then introduced as representatives of the National Association of Finishers of Textile Fabrics. Mr. Edgerton described the efforts of his Association to provide fabric standards acceptable generally to the industry and retail trade, and expressed his appreciation of the color fastness standards furnished by our Association. It was voted by the Research Committee that its Chairman be authorized to approve, for joint presentation to the National Bureau of Standards, the report of the National Association of Finishers of Textile Fabrics presented by Mr. Edgerton, entitled Color Fastness Specifications for Dyed or Printed Cotton or Linen Piece or Woven Materials.

Respectfully submitted,

H. C. CHAPIN, *Secretary.*

MEETING, NORTHERN NEW ENGLAND SECTION

A MEETING of the Northern New England Section was held at the Andover Country Club, Andover, Massachusetts, on Friday, November 17, 1939.

There were sixty members present at the dinner, and about seventy-five members attended the business meeting and technical program which followed.

At the business meeting Mr. H. P. Selya, Chairman of the Outing Committee, submitted his financial report on the outing held last June. Mr. W. H. Zillessen, who so ably conducted our national convention last September, also submitted his financial report of that convention.

An informal verbal report of the meeting of the National Council was given by Mr. K. H. Barnard. Following this report motions were made, seconded and voted upon that the present incumbents, Dr. Walter M. Scott and Mr. K. H. Barnard be re-elected as members of the National Council for the year 1940, beginning in January, 1940.

For the technical part of the program Dr. G. L. Royer and H. E. Millson of the Calco Chemical Company presented colored slides and a colored motion picture, which were shown in Boston at the annual meeting in September, entitled, "Microscopic Observations of Wool Dyeing," and "Wool Dyeing Phenomena."

In response to many requests, these pictures were presented again to our Section for the benefit of those who missed them. They were thoroughly enjoyed and were an excellent illustration of the laboratory technique developed by the speakers in a study of wool dyeing phenomena. The authors admitted they had made only a beginning in the study of this complex physico-chemical mechanism, but they are to be congratulated on their splendid start.

At the close of the above program, a short question and answer period was held, with Dr. Royer and Mr. Millson answering questions raised by the members.

Respectfully submitted,

JOHN N. DALTON, *Secretary.*

MEETING, SOUTH CENTRAL SECTION

THE fall meeting of the South Central Section was held on Saturday, Dec. 9, 1939, at the Andrew Johnson Hotel, Knoxville, Tenn. This was the date of the Uni-

versity of Tenn.-Auburn football game, the outcome of which put Tennessee in the Rose Bowl. The celebrating University of Tennessee band entered the dining room during the banquet and vigorously played "California, Here We Come!" This added considerably to the spirit of the occasion.

The principal speaker of the evening was Mr. P. H. Stott, Head Chemist in charge of Research in the Dyeing of Nylon for the du Pont Company. Also on the program was Dr. John L. Kind, Prof. of German at the University of Tennessee, who gave a very thorough outline of Adolph Hitler's "Mein Kampf." Dr. Walter M. Scott, of the new Federal Southern Research Laboratories, New Orleans, La., was present and was introduced.

Following the program the annual election of officers for the year was held. Mr. H. A. Rodgers was chairman of the nominating committee. The new officers for the coming year are:

Chairman, Fletcher L. Kibler, United Hosiery Mills, Chattanooga, Tenn.

Vice-Chairman, W. S. McNab, Quaker City Chemical Co., Knoxville, Tenn.

Secretary, Frank F. Myers, Geigy Co., Inc., Chattanooga, Tenn.

Treasurer, Andrew J. Kelly, Burkart Schier Chemical Co., Chattanooga, Tenn.

Councilor, Homer Whelchel, Central Franklin Process Co., Chattanooga, Tenn.

Mr. Nestor Grotelueschen presided over the meeting and reported a substantial gain in members in the past two years.

This was the best attended meeting ever held in Knoxville. Ninety-eight members and guests attended.

Respectfully submitted,

FRANK F. MYERS, *Secretary.*

ANNUAL MEETING, INTER-SOCIETY COLOR COUNCIL

THE annual meeting of the Inter-Society Color Council is to be held jointly with the Optical Society of America and the American Physical Society, February 21-24 in New York City. The technical session is to be co-sponsored by the Technical Association of the Pulp and Paper Industry and will be held on February 21, during their annual meeting at the Roosevelt Hotel.

Delegates and members of the Council are urged to be present. Members of all member bodies, and any others interested in color, are invited to attend the sessions. The program will be announced more completely, both in the Bulletin of the American Physical Society, and in the program of the Technical Association of the Pulp and Paper Industry.

PROGRAM

February 21

2:00 P.M.—*Technical Session on Spectrophotometry in the Pulp and Paper Industry,* to be held in the Hendrick Hudson Room of the Roosevelt Hotel.

Chairman: John L. Parsons, Hammermill Paper Company.

Introduction: Dialogue: Mr. Papermaker and Mr. Meter.

Survey of Instruments:

1. Survey of Spectrophotometers—K. S. Gibson, National Bureau of Standards.
2. Survey of Abridged Spectrophotometers—J. A. Van der Akker, Institute of the Paper Chemistry.
3. Survey of Instruments in Use in the Pulp and Paper Industry—(by title).

Use of Instruments:

4. In Pulp—R. S. Hatch, Weyerhaeuser Timber Company.
5. In Beater Furnish—R. N. Griesheimer, Mead Corporation.
6. In Uncoated Paper—Myrl N. Davis, Kimberly-Clark Corporation.
7. In Coated Paper—William J. Foote, Consolidated Water Power and Paper Co.

8:00 P.M.—*Popular Session*: *Parade of Color,* to be held at the auditorium of the Electrical and Gas Association of New York, 480 Lexington Avenue (where meetings were held last year).

February 22

9:30 A.M.—*Discussion Session*: Deane B. Judd, Chairman—Hendrick Hudson Room, Roosevelt Hotel. Topics for discussion to be announced.

1:00 P.M.—*Luncheon Groups*—to continue discussions of morning session.

2:30 P.M.—*Business Session*: Reports of committees, and of chairman of delegates from each member body. (All reports should be in writing so that they may be included in the report of the meeting.)

February 23-24

Joint Meetings with the Optical and American Physical Societies at Columbia University. These will include a symposium on *Optical Methods for the Study of Molecular Structure.*

Admission to the evening session is by ticket only, but those tickets may be procured without cost from the secretary of the Council. It would facilitate matters if such requests were accompanied by a stamped, self-addressed envelope. Requests for tickets should be addressed to: Inter-Society Color Council, P. O. Box 155, Benjamin Franklin Station, Washington, D. C.

Twentieth

ANNUAL MEETING AND CONVENTION

HOTEL COMMODORE

NEW YORK CITY

OCTOBER 18TH AND 19TH, 1940

General Chairman

PATRICK J. KENNEDY

◆

PUBLICITY COMMITTTEE

PLANS are under way, which have not been completed, to have the following men serve on the publicity committee:

Clarence L. Nutting, Chairman, Northern New England Section.

Allison R. Fletcher, Chairman, Rhode Island Section.

Louis S. Zisman, Chairman, New York Section.

Harold B. Dohner, Chairman, Philadelphia Section.

H. E. Kiefer, Jr., Chairman, Piedmont Section.

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Herman Boxser, Chairman, Midwest Section.

Robert W. Philip, Chairman, South-Eastern Section.

Norman A. Johnson, American Dyestuff Reporter.

Ray G. Doyle, Publicity Manager, Commodore Hotel.

◆

Auspices of

NEW YORK SECTION

HENRY F. HERRMANN
Vice-Chairman
In Charge of Publicity

HENRY F. HERRMANN, New York Sales Manager of the General Dyestuff Corp., has agreed to accept the position of vice chairman, in charge of publicity. He is particularly well suited for the position of vice chairman as he has had considerable experience in arranging previous affairs of the Association. He has been an active member, in name and spirit, for many years and is a past chairman of the New York Section. He was general chairman of the committee on arrangements for the last annual meeting and convention held in New York City in 1934. He is at present identified with the Association as a member of the research committee and the committee on coordination as well as being a councilor from the New York Section. The personnel of Mr. Herrmann's committee appears at the left.

AMERICAN
DYESTUFF
REPORTER

A. P. HOWES
Publisher

LOUIS A. OLNEY, Sc.D.
Professor of Chemistry and Dyeing, Lowell Textile Institute
Directing Editor

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LAST YEAR, NEXT YEAR—AND THE WAR

IN a recent statement, Secretary of Commerce Harry L. Hopkins reported substantial gains in all areas of the national economy during 1939. He said further:

"This improvement has produced a more favorable background in which to consider and to appraise common problems of government and business—and a calm appraisal is a necessary prerequisite to intelligently guided action. The outbreak of war in Europe has not been without its repercussions in this country, but this unfortunate event must not blind us to the fact that the solution of our problems lies with us. We can not rely upon destruction abroad to create a demand for goods which, in the proper sense, can be fostered here with advantage to all.

"In looking back at the year, it is possible to record a very substantial gain in all areas of the economy when measured against the relatively restricted volume of 1938. The year divides into two rather well-defined periods delimited by the date of the war outbreak in Europe. Prior to September, the recovery in business which featured the latter half of 1938 proceeded at a slow pace, but upon a gradually broadened base, with prospects that this movement would be extended through the final months of the year.

"In September, this measured improvement gave way to a sharp spurt produced by readjustment in company policies that followed the war. Large-scale purchasing appeared on commodity markets, soon followed by active covering of future needs over a widening range of raw, semi-finished and finished products. Sales of capital goods increased substantially as outlays under consideration were quickly advanced to the purchasing stage."

Production during 1939, in some instances, reached highs which had never been reached before. Steel output in October was higher than in any previous month and rose still more in November. Consumption of cotton in this country in October and November was the highest for those months on record. Year-end industrial inventories did not show the increases which have been characteristic of other years, such as of 1936.

Exports in 1939 were approximately the same as in 1938, slightly more than three billion dollars. The outbreak of war caused some shift in the volume and destination of our export trade but there was no great effect on the total. While increased foreign trade would stimulate domestic activity in 1940, the highly uncertain conditions which exist abroad would prevent depending too much on this.

There is some difference of opinion as to how much of improved business conditions are due to the war and how much to the independent recovery which was already underway at home. There is no doubt but what the forward movement had been in effect for some time before the outbreak of the war; however, it was probably stimulated considerably when war started, in the belief that there would be large scale purchases by the active praticipants. On the other hand, when the expected large war purchases failed to materialize it did not halt our own recovery movement. At least, it has not so far. Whether trade revival was built up in expectation of a "war boom" which did not eventuate, it is impossible to judge. Nor have we yet had an opportunity to judge what effect the withdrawal of our ships from profitable points of ocean commerce will have.

When highly qualified persons are hesitant about making predictions for 1940, or disagree with other forecasts when they do, we shall not attempt to tell you what to expect. The high rate of activity in recent months stimulated considerable purchasing power on the part of consumer and industry alike, which in turn will probably have the effect of still further increasing business activity as it gathers momentum. The high production figures of 1939, particularly the latter part, do not guarantee high production for 1940; it may go down or it may go still higher, depending upon varying influences—domestic consumption, foreign trade and the war situation. As far as 1940 is concerned there is no doubt that the European war will have its effect on it, i.e., whether it continues or whether it is abruptly terminated. It becomes evident that one of our best prospects of increased activity is to achieve a balance between the limits of our domestic production and utilization goods.

And then again, we have an election this year.

Nomograms

for Various Plant and Laboratory Computations

LEONARD SHAPIRO*

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I. VOLUME OF CYLINDRICAL TANKS

THE accompanying nomogram is quite useful in determining the volume in gallons of a vertical cylindrical tank, vat, or drum when the diameter and the height of the liquid are known in inches.

The computation is accomplished by connecting the figure representing the diameter on the left-hand scale with that representing the height on the right-hand scale. This may be accomplished with a ruler, a piece of string, or any straightedge. The intersection of this line with the center scale indicates the number of gallons contained in the tank. For example, if a 36-inch tank is filled to a height of 30 inches, the volume (as found by drawing a line from 36 on the left-hand scale to 30 on the right-hand scale, and reading the intersection with the center scale) is 132 gallons.

II. NOMOGRAM FOR CONVERSION OF YARDS-PER-POUND TO OUNCES-PER-SQUARE-YARD

The accompanying nomogram greatly simplifies the interconversion of the two widely used methods of expressing fabric weight. The width, on the right-hand scale, is connected with the known figure for ounces-per-square-yard or yards-per-pound on the left-hand scale. The solution is read at the intersection of this line with the center scale. Since the two weight systems are reciprocal, the center and left-hand scales are interchangeable, and either may be used for yards-per-pound giving the corresponding number of ounces-per-square-yard on the other.

For example, let us take a fabric 42 inches wide weighing 2.50 ounces-per-square-yard. Connecting 2.50 on the left-hand scale with 42 on the right-hand scale, we read 5.50 yards-per-pound on the center scale.

On the other hand, if we have a 5.50 yard-per-pound fabric 42 inches wide, and we wish to determine the square-yard weight, it is only necessary to connect 5.50 (again on the left-hand scale) with 42 on the right-hand scale, and we may read 2.50 ounces-per-square-yard on the center scale.

III. CORRECTION OF YARN OR FABRIC STRENGTH TO 7½% REGAIN

The accompanying chart is a nomographic expression of the Haven strength correction formula:

$$S_c = S_m \frac{100 + rR}{100 + rR_m}$$

S_c = Corrected strength
S_m = Actual strength (machine reading)
R = Standard Regain
R_m = Actual Regain
r = Correction Rate

Use of this formula involves knowledge of the correction rate, r, to be applied to the yarn or fabric in question. (r = % change in breaking strength per % change in moisture regain, based on "bone-dry strength.")

For routine testing of yarns or fabrics of a particular type or construction, it is advisable to determine the correction factor experimentally. For rough work, or where the correction factor is unknown, the following factors given by Haven will furnish a convenient approximation:

Cotton Yarns		*Cotton Fabrics*	
Count	*r*	*Oz./Sq. Yd.*	*r*
Above 20s	5.2	1.5- 4	4.0
10s-20s	6.0	4 -10	5.0
2s-10s	7.7	10 -18	7.0
Below 2s	10.1	18 -48	10.0

In constructing the nomogram, a standard regain of 7½ per cent was chosen in accordance with the recent decision of A.S.T.M. Committee D-13.

Example: Suppose a skein of 28s yarn is found to break at 42 lbs. The regain is found to be 4.7 per cent, and the correction rate is known to be 2.2 per cent. The corrected strength is obtained by connecting 2.2 on the bottom scale with 4.7 on the regain scale. From the intersection of this line with the turning scale, Q, a line is drawn through the strength, 42 lbs., on the diagonal scale, and the corrected strength is read at the intersection of this line with the right-hand scale—viz. 44.3 lbs.

(For strengths above 100 lbs., the decimal point may be moved to the left, and the decimal point in the corrected value moved back to the right.)

IV. NOMOGRAM FOR CORRECTION OF FABRIC STRENGTH TO 7½% REGAIN

In the application of Haven's correction formula to fabric strengths, Schwarz has observed that the correction rate, r, is very nearly equal to $2\sqrt{w}$ (where w = the square yard weight in ounces), over a wide range of cotton fabrics. Replacing r by $2\sqrt{w}$ in Haven's formula, we obtain for the correction to 7½% regain:

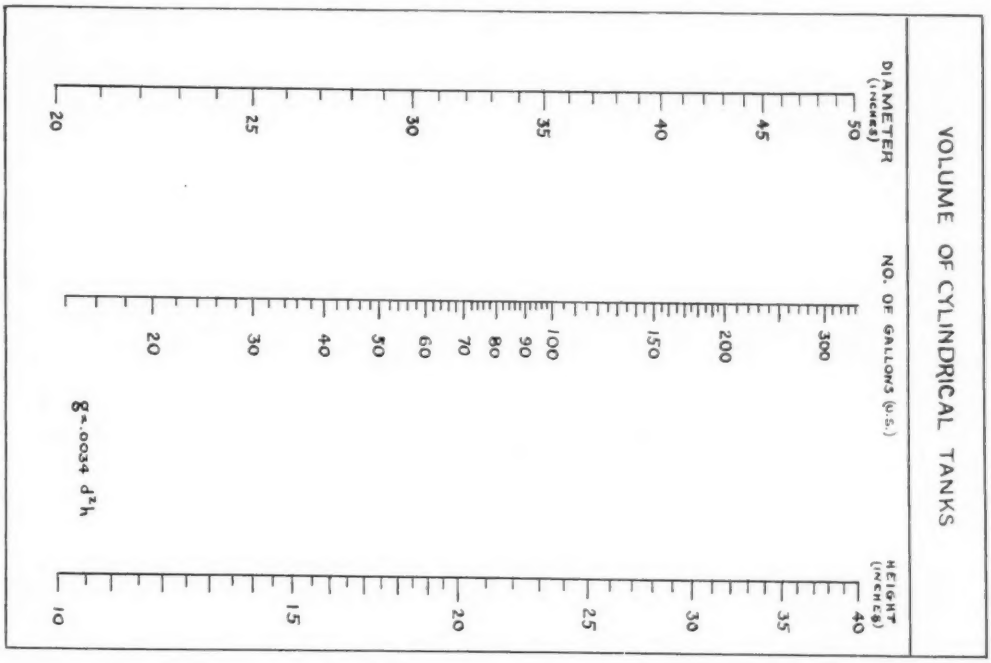
*Director of Laboratories, Interlaken Mills.

$$S_c = S_m \frac{100 + 15\sqrt{w}}{100 + 2R_m\sqrt{w}}$$

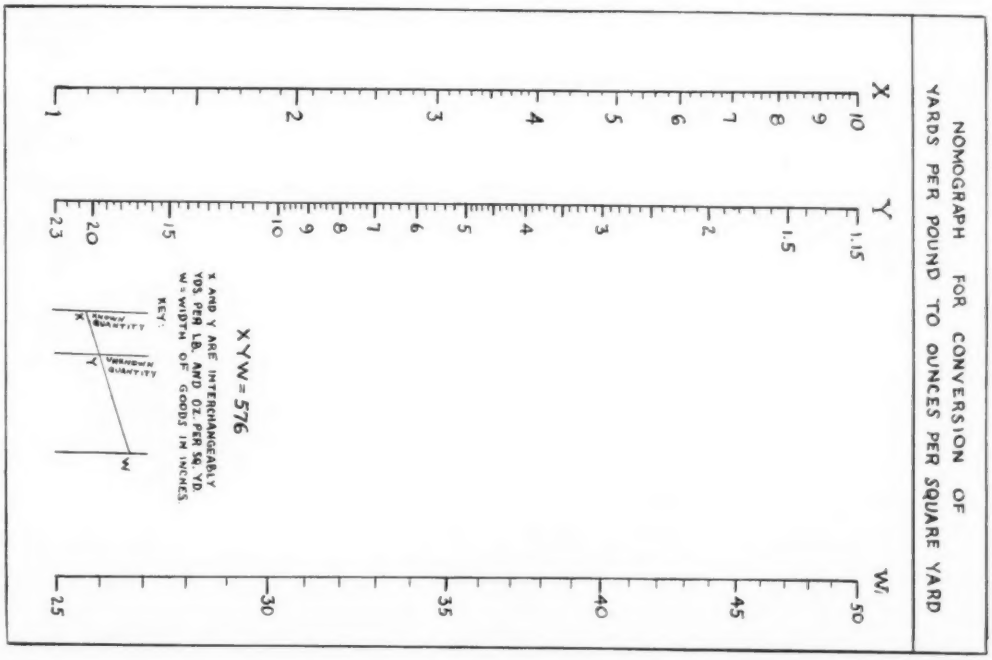
The accompanying nomogram gives a fairly simple solution to this equation. Thus, if a 4.25 oz./sq. yd. cotton fabric is found to break at 41.5 lbs., and the regain is found to be 3.8 per cent, the solution is obtained as follows: Draw a line connecting 4.25 oz. on the bottom scale with 3.8 on the regain scale. From the intersection of this line with the turning scale, Q, draw a line through 41.5 lbs. on the diagonal scale, and read the corrected strength at the intersection with the right-hand scale—viz., 47 lbs.

(For strengths over 100 lbs., the decimal point is moved one place to the left, and the decimal point on the corrected strength value is moved back one place to the right.)

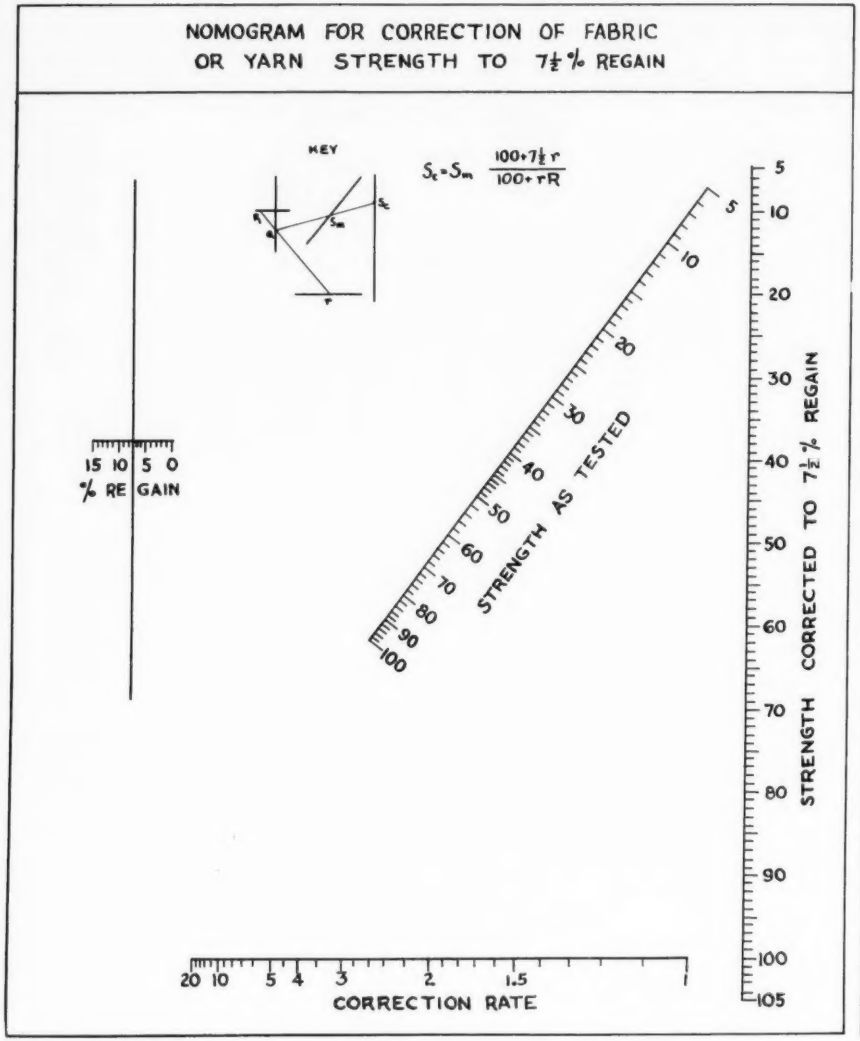
I



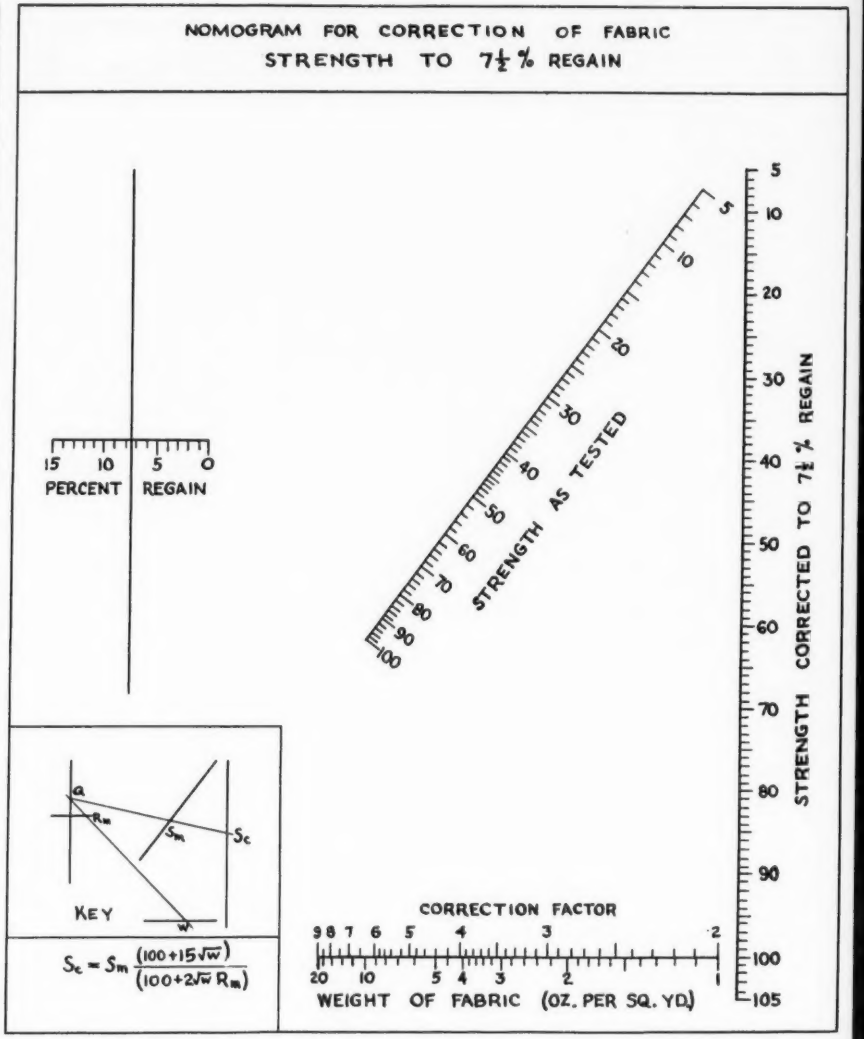
II


NOMOGRAPH FOR CONVERSION OF YARDS PER POUND TO OUNCES PER SQUARE YARD
X
Y
W
XYW = 576
X AND Y ARE INTERCHANGEABLY YDS. PER LB. AND OZ. PER SQ. YD.
W = WIDTH OF GOODS IN INCHES
KEY:
KNOWN QUANTITY
UNKNOWN QUANTITY

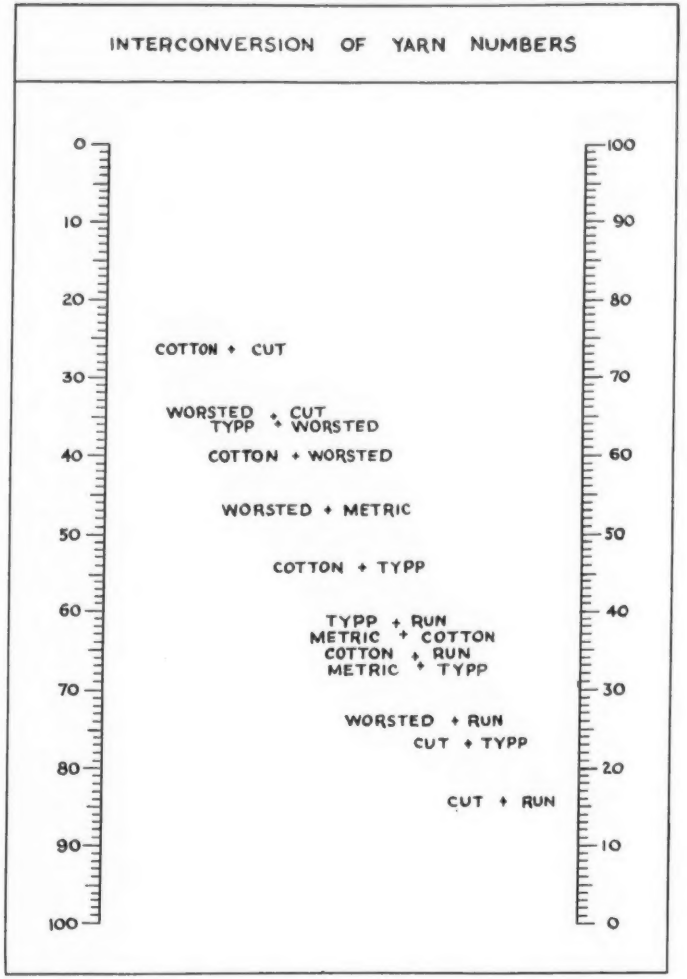
III


NOMOGRAM FOR CORRECTION OF FABRIC
OR YARN STRENGTH TO 7½% REGAIN
KEY
$S_c = S_m \frac{100+7\frac{1}{2}r}{100+rR}$
15 10 5 0
% RE GAIN
STRENGTH AS TESTED
STRENGTH CORRECTED TO 7½% REGAIN
20 10 5 4 3 2 1.5 1
CORRECTION RATE

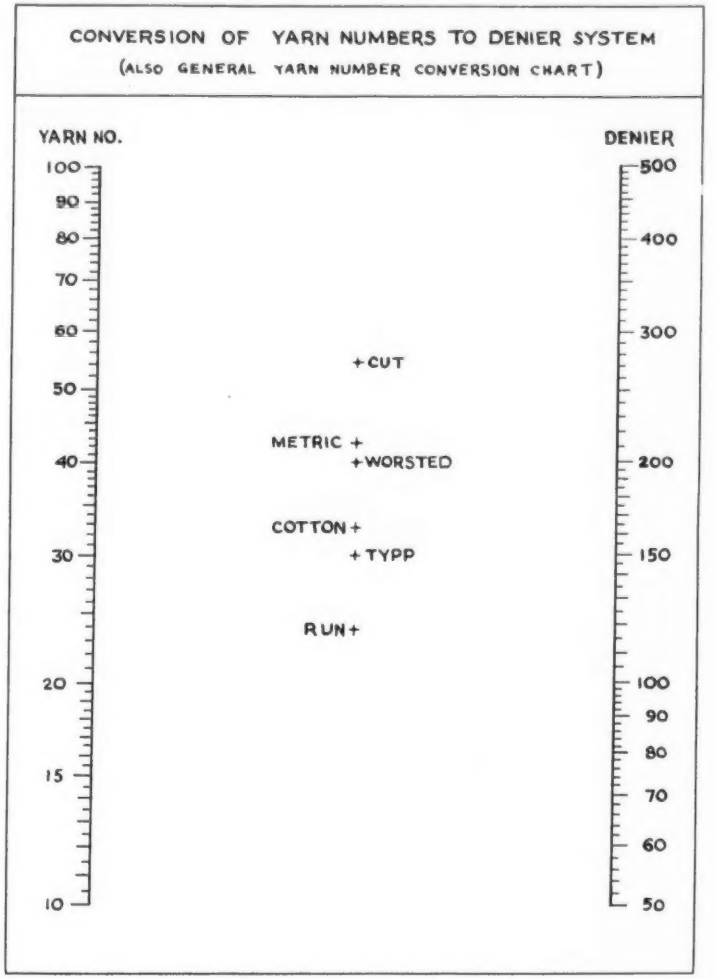
IV

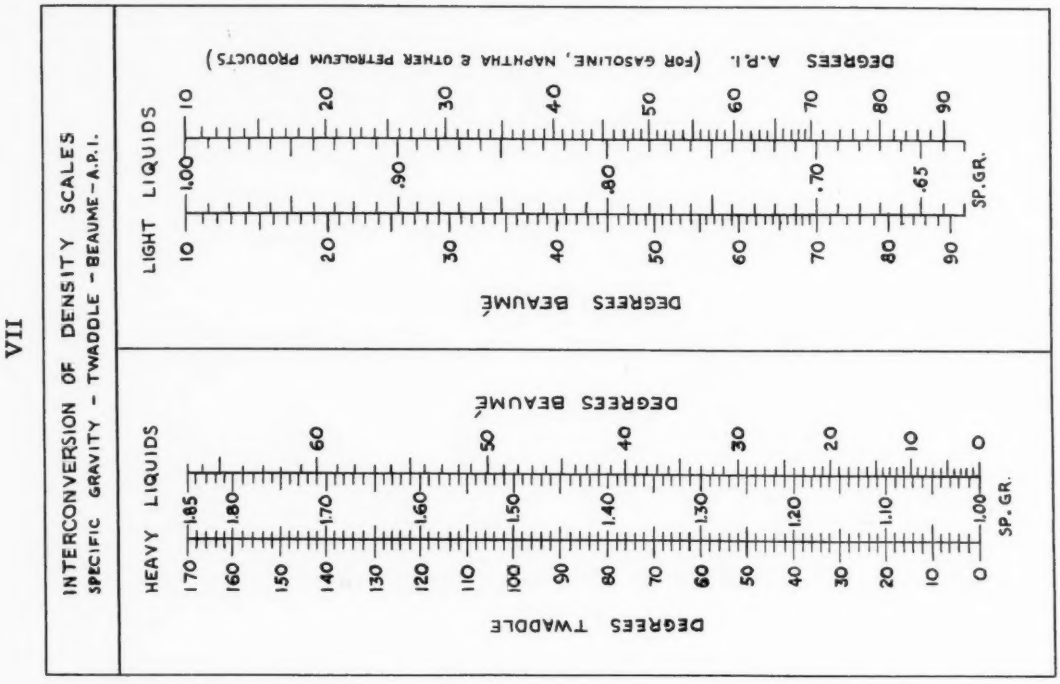

NOMOGRAM FOR CORRECTION OF FABRIC
STRENGTH TO 7½% REGAIN
15 10 5 0
PERCENT REGAIN
STRENGTH AS TESTED
STRENGTH CORRECTED TO 7½% REGAIN
KEY
$S_c = S_m \frac{(100+15\sqrt{w})}{(100+2\sqrt{w}R_m)}$
CORRECTION FACTOR
20 10 5 4 3 2 1
WEIGHT OF FABRIC (OZ. PER SQ. YD.)

V


INTERCONVERSION OF YARN NUMBERS
0
10
20
30
40
50
60
70
80
90
100
100
90
80
70
60
50
40
30
20
10
0
COTTON + CUT
WORSTED + CUT
TYPP + WORSTED
COTTON + WORSTED
WORSTED + METRIC
COTTON + TYPP
TYPP + RUN
METRIC + COTTON
COTTON + RUN
METRIC + TYPP
WORSTED + RUN
CUT + TYPP
CUT + RUN

VI


CONVERSION OF YARN NUMBERS TO DENIER SYSTEM
(ALSO GENERAL YARN NUMBER CONVERSION CHART)
YARN NO.
DENIER
100
90
80
70
60
50
40
30
20
15
10
500
400
300
200
150
100
90
80
70
60
50
+CUT
METRIC +
+WORSTED
COTTON +
+TYPP
RUN+



V. INTERCONVERSION OF YARN NUMBERS

This nomogram permits rapid conversion of yarn numbers from one system to another. To convert, for example, from the cotton to the worsted system, the cotton number is located on the left-hand scale, and a straight-edge is laid from this number through the "Cotton-Worsted" point (marked by the intersection of the small cross) to the right-hand scale, where the worsted number is read. To convert from the worsted number to the cotton number, the reverse procedure is followed.

Example 1: To convert 20s cotton to the Typp system, extend the straight-edge from 20 on the left-hand scale through the "Cotton-Typp" point to the right-hand scale, where the Typp number, 16.8, is read.

Example 2: To convert 70s metric to the worsted system, locate the worsted-metric point in the center of the diagram. Since the metric designation is to the right of the point, the straight-edge is drawn from 70 on the *right*-hand scale through the "Worsted-Metric" point to the left-hand scale where the worsted number is found to be 62s.

VI. CONVERSION OF YARN NUMBERS TO THE DENIER SYSTEM

By the use of this chart, yarn numbers may be converted to denier numbers and vice versa. The yarn number is located on the left-hand scale, and a straight-edge is extended from this number through the appropriate point in the center of the diagram (marked by the small cross-intersection next to the name of the system used) to the denier scale on the right.

Thus, to convert 20s on the run system (woolen or linen) to deniers, a line is drawn from 20 on the yarn number scale at the left through the point marked "Run" to the denier scale at the right, where a denier number of 140 is indicated.

By using the denier scale as a turning-scale, this chart may be employed as a general yarn number chart for *all* systems. Thus, to convert 20s cotton to the Typp system, the straight-edge is extended from 20 on the yarn number scale through the point marked "Cotton." The intersection with the denier scale is marked with a pencil point or a pinpoint, and the straight-edge is then rotated about this point until it passes through the point marked "Typp." Then, reading back on the yarn number scale at the left, we obtain 16.8s as the Typp number.

VII. INTERCONVERSION OF DENSITY SCALES

The number of different density scales used in the textile industry is a little confusing, and it is often convenient to use a hydrometer graduated in one system and convert the reading to another system. The accompanying chart makes it quite simple to perform this transformation.

The use of the scales for heavy liquids is fairly obvious. In the case of liquids lighter than water, the basis for the Baumé scale is somewhat arbitrary, and the A.P.I. gravity (used for petroleum products) differs very slightly from the regular American Baumé scale, as indicated in the nomogram.

Important Chemical Developments

(Continued from Page 8)

exchange resins is that the ordinary types of synthetic resins are chemically indifferent, whereas the exchange resins are chemically very reactive compounds. They are manufactured in a way as to maintain their character of high molecular acids or bases. The structure of these resins is that of a gel, having a very large inner surface, which increases the reactivity of these resins to a great degree. These resins are being used in Europe by various mills very successfully. These two systems, that is the water softening system based on the Zeolite principle and the resin softening system are being run side by side in a very large European rayon plant. The results are extremely interesting and very much in favor of the resin system. The capacity of the same plant, simply by substituting the resin filling for the Zeolite filling was stepped up from 1200 cubic meter per day to 3000 cubic meter. That is more than twice the former capacity. The possibilities of this new way of water softening are quite apparent: either an increase in the capacity of the same size plant or a considerable saving in space and cost for the same capacity. There are many other features connected with this new development of which only the possibility of removal of salt up to 97 per cent, as well as heavy metals, may be mentioned. So it might be possible to get water nearly as pure as distilled water that way. Even the pH of water may be changed at will by selecting the right resins.

The science of ionization has contributed greatly in enabling us to understand the reactivity of textile fibers. It has led to new conceptions about dyeing and finishing, or textile processing in general. For example—If scoured wool fiber is immersed in the usual latex solution, there is little deposition of rubber upon or within the fiber, because both have the same electrical charge, that is, both have a negative charge. So in order to secure a rubber deposition on wool, the charge on one of the components has to be changed. This is effected by incorporating a quaternary ammonium compound (in other words, a cationic soap) in the latex solution so that the rubber particles acquire a positive charge. Applying these ideas, wool materials can be given a rubber content of 5 to 15 per cent by immersing them in an alkaline dilute latex solution whose rubber particles have been given a positive instead of their normal negative charge. Under these conditions, the rubber particles steadily migrate towards the wool fibers, like dye particles in an acid dye bath. Exhaustion of the latex solution is almost complete, because the affinity of the particles has been changed. It is further possible to add vulcanizing agents and in this way vulcanized rubber particles are produced without precipitation of rubber. It has been found that tensile strength of wool is increased several times by this rubberizing treatment. The most satisfactory results are obtained with a deposit of 7 per cent to 10 per cent of rubber.

In this connection a new development for wool carpets might be of interest. The National Automotive Fibers Inc., in Oakland, Cal., has developed a rubber and wool carpet which has wool fibers in the pile embedded in foam rubber latex base. This is supposed to cost less than conventional broadloom carpets. The softness of the carpet can be regulated by varying the thickness of the rubber base. The Mohawk Carpet mills have acquired the license to manufacture and sell this carpet.

Let us apply ionization in connection with *vegetable* fibers. When an inorganic or an organic compound is dissolved in water, it usually dissociates into so-called ions, which art electrically charged particles. These particles are charged positively and negatively and are in balance. In other words, their number is the same. The particles carrying a positive electrical charge are called cations, the ones with a negative charge are called anions. Now most of the older and even many of the later types of textile assistants are what is called "Anion active." That means that the really important part of the molecule—in most cases the "fatty" part is not attracted to the fiber which is charged negative in water. In other words, the assistant has no affinity for the fiber. So the thing to do would be to make a compound whose important or effective part of the molecule is positively charged and which then would be attracted to the fiber. This has been done in the case of the so-called "cation active compounds" about which we have heard so much lately. These new materials are mostly derivatives of nitrogen bases, built around substituted Ammonium hydroxide (quaternary ammonium compounds) or the cyclic or heterocyclic nitrogen compounds, such as pyridin. Already quite a number of these materials are on the market. Since they are strongly attracted to the fiber, they create a rather strong bond which is physical as well as chemical and produce a soft finish which withstands several washings and in some cases organic solvents, such as are used in dry-cleaning. Some of them combine with dyestuffs and make the dyeing faster to washing and water. So it can be seen, that we are able by controlling the electric charge in the system,

fiber-water-textile assistant, to determine the affinity of one part to the other. The bond between fiber and these new finishing materials is, as mentioned before, only physico-chemical, although it is more intimate than that of other compounds. Yet it is only about in between a fiber coating proposition, such as most finishing or waterproofing processes represent and a real new chemical compound with the fiber material itself. However, there is a development which goes a great step towards that "ideal" process, and that is not merely to deposit something on the fiber, to coat the fiber—but to effect a chemical reaction between the fiber and the finishing or waterproofing compound. This new development is just a step removed from the quaternary ammonium compounds we dealt with a moment ago. I am referring to the waterproofing process with Velan, or Zelan, as it is called in England where it originated. It reacts with the cellulose molecule when heated and makes the fiber "hydrophobe", which means the fiber is not wetted by water any more. Wetting of cellulose is a function of the swelling properties of cellulose, which in turn is caused by OH or CH_2 groups of the cellulose molecule. If these groups are blocked by fatty groups, then the action of water, that is: swelling and then wetting cannot take place any more. This was done first by making an oxymethylether of cellulose with solutions of a fatty compound in pyridin. This process did not work out in practice since pyridin was used as solvent. If pyridin, however, is used as a component by changing the same oxymethylether into a quaternary compound with pyridin, a water soluble compound is obtained with which the cotton is impregnated. The material is then carefully dried and after it is completely dry it is baked for a short time at about 120° C. The material is then hydrophobe, that is: permanently waterproof,—fast to washing and dry cleaning. It is extremely interesting from the chemist's point of view how that one simple observation, namely that by drying this compound (to avoid decomposition) and subsequent baking pyridine is made a component rather than used as a solvent,—so a process which was first practically useless was made one of the major achievements in textiles. The value of this process is further increased by the fact that it imports a very nice, soft and full hand to the fabrics.

This process resembles somewhat the well known crease resisting process with formaldehyde condensates. As a matter of fact both processes can be combined. In order to make a fabric waterproof and creaseproof in one operation a derivative of urea containing a fatty alcohol radical is employed—stearyl urea. This is condensed with formaldehyde and pyridine in presence of HCl. Fabrics are treated with this condensate (stearylureidomethyl pyridinium chloride), which is water soluble, then squeezed, dried and baked at 110° C. for 10 minutes. The effect is to make the material water repellent, crease-proof with a soft finish, fast to washing and dry cleaning in one operation.

We are still living in the era of converted fibers, that is to say, we are still at work improving their properties to make them better adapted for our needs. It would take a long paper to cover all the developments which have taken place in recent years, but it might be in order to just get a birds-eye-view of the more fundamental ones. It will be simpler to keep these developments before us if we realize that there is little we can do to change the primary properties of the textile fibers, even of the so-called man-made fibers. After all, we cannot change the materials out of which these fibers are made, except in the case of cellulose esters such as acetate. We can of course, make some superficial modifications, but no fundamental changes. The properties which we can and do modify are the secondary properties and it is here that many developments have taken place. For instance—the property of resilience, the hand of a fabric, its resistance to creasing and to stresses during wear are a direct function of resilience. The absence of this property in cotton and the rayons makes these fibers so different from wool. This can be improved by treatments with resins. These resins can also be incorporated inside of the fibre during the manufacturing process. Cellulose acetates have a certain inherent resilience which makes them suitable for wool-like materials. Hygroscopicity is another important secondary property. All natural fibers are hygroscopic, so are viscose and cuprammonium rayon. Acetate is much less hygroscopic. We can modify this property in case of all the rayons by suitable treatments. Then we have cross-sectional shape. This is a property which we can not change in natural fibers but we can control that in the man-made fibers. That is the reason why we are able to make fibers for many special purposes such as carpet yarns. We have a very simple way of changing one of the primary properties of fibers—strange as it may sound—that is, we can change the form of rayons. The form of a fiber is the proportion of its diameter to its length, in other words, its staple length. Since we can spin rayons as fine and even finer than natural fibers and since we can cut them to any length, we have it in our hands to change this property at will. That is the way we get staple fiber and you all know the tremendous strides this latest modification of converted fibers has made. With this product we can do all the things we are doing with the long filament rayons and some more. For instance. we can impart to it crimp, a property which in conjunction with others is very important indeed and only possessed by fine wool fibers. Many of the staple fibers are now available with a so-called permanent crimp. However, this question of crimp still needs much clarification, that is to say: how permanent is it in the various staple fibers. how much of a crimp is desirable and how do these fibers behave in the spinning and other processes and in the finished cloth?

There has been another interesting innovation in the field of converted or man-made fibers in recent years and that is the utilization of protein for making fibers related to wool. This is a development which rounds out the picture of man-made fibers which until lately was confined to the field of vegetable fibers. This is really nothing fundamentally new, for it was attempted 35 years ago in Germany although not perfected commercially. An Italion chemist, Feretti, revived this process a few years ago and developed it into a commercially feasible process. This development, very much like the phenomenal rise in the use of staple fiber, was compelled in a large measure by the urgent need of substitutes for natural fibers in the so-called totalitarian countries. Just the same, necessity has helped the development along, which otherwise would have been neglected. Fairly large quantities of these protein fibers are being made in Italy and Germany from casein, that is from skim milk. The interest in these protein fibers, however, is by no means confined to these countries. We are interested in this subject right here in this country. For instance, the Department of Agriculture wants to help the farmer by finding new uses for his products, also the big dairy companies are interested in the same subject. Considerable research has been done on casein fiber and fiber has been made on a semi-plant scale by at least three companies. It has been announced sometime ago, that the National Dairy Products Corporation is equipping a plant in Rhode Island. Three patents have been granted on casein fiber to two chemists of the Department of Agriculture, which are dedicated "to the free use of the people of the United States." The first patent claims a fiber comprising casein, salts of casein and fat acids, also a fiber with the aluminum salt of casein as a component. The difference between this patent and Feretti's patent is that no specifically prepared casein is required. The second patent is interesting, because it covers the use of skim milk for direct manufacture of the fiber, without first separating the casein. The third patent covers the use of phosphoric acid and phosphates in the precipitating bath. I think it is fair to say, that in this country the casein fiber in its present state would not be accepted as being suitable as a textile fiber. Most important of all, it has a comparatively low tensile strength, especially when wet. Its strength is about half that of wool and its elongation only about one-third. Besides, it has many other shortcomings. But, most of us remember that 10 or 20 years ago rayon was not the fiber which it is today and doubtless, casein fiber will be improved in the near future. It might be interesting to recall that a sheep produces about 7½ lbs. of wool a year, while a cow produces enough milk a year to make about 100 lbs. of casein fiber. There is enough skim milk available in this country for a potential production of one billion pounds of casein fiber a year. Besides milk, there are other sources of protein studied, especially the soy bean. This protein, of course, is of a somewhat different nature than milk protein because soy bean protein is of vegetable origin. Indications are that this development promises some very interesting results and it should not be overlooked or regarded too lightly by any means.

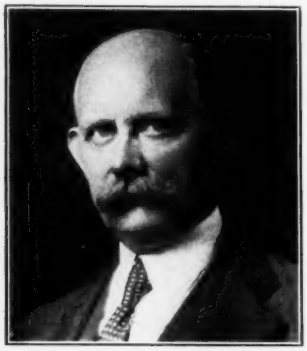
Just one word about another new (or old) fiber—glass fiber. While this fiber has not the properties necessary for a textile fiber it is worthy of note here because its use as a fiber for industrial uses is widening considerably lately.

I am now coming to the latest and by far the most important and revolutionary development of all, revolutionary not because it is merely a new invention—it is much more than that. It is an entirely new approach to the question of textile fibers. It goes deeper than to just making another fiber of some natural raw material. It means the production of a new material, not found in nature, with which to make textile fibers. This material has all the primary and secondary properties that make it suitable for use as a textile fiber. Two of these new fibers have made their appearance on the market in limited quantities —DuPont's "Nylon" and Union Carbide's "Vinyon." Both will be in volume production next year. They belong in the class of synthetic resins and can be synthesized from simple organic compounds which are available in unlimited quantities and relatively cheap. Vinyon belongs to the group of so-called vinyl-chloride-vinyl acetate co-polymers. Its low melting point and poor affinity to available textile dyes, however, limits its uses for the time being. The other product, nylon, is made by combining a dibasic acid with a diamine and subsequent polymerisation of the resulting amide. The fibers made from this raw material are superior to natural fibers in many respects, they are very strong both in the dry or in the wet state, have a very high elasticity (several times that of silk), are not affected by moisture or heat and have a good affinity for dyes. It is no over-statement to say that this is the greatest textile development of our time because it is destined to usher in a new era in textiles. It means that we are beginning to really become independent of nature. We do not have to take what nature gives us and use these raw materials to make products for our use. Now we are making our own raw materials from the same building blocks that nature is using, but we arrange these building blocks to suit our needs and wants. We will be able to incorporate most qualities into these raw materials and do not have to resort to a great many processes to make them suitable for whatever we want to use them. These changes in raw materials will not only alter the chemical processes, they will also alter the fabrication of textiles. They will affect tremendously your preparatory processes such as carding, combing, spinning and weaving, perhaps eliminate most of these processes to a large degree. The textiles of the future might be made by just combining sheets of slightly carded fibers without twisting, spinning or weaving operations, with the resulting fabric resembling something between paper and felt, but stronger than either.

OBITUARY

JOSEPH F. X. HAROLD

DR. JOSEPH F. X. HAROLD, for twenty-eight years a consulting chemist on textile and dyeing problems for the William M. Grosvenor Laboratories, Inc., 50 East 41st Street, New York City, died



on Wednesday, January 3rd, 1940, at the Hospital for the Ruptured and Crippled, New York City, after an illness of three months. For some time previous to that he had been in ill health. He was sixty-five years of age.

He was born on August 11th, 1874, in Philadelphia and graduated from LaSalle College in 1892, later obtaining Bachelor of Science and Doctor of Philosophy Degrees from the University of Pennsylvania. From 1896 to 1897 he taught chemistry and physics at Villanova College and for the next eight years he was a professor of chemistry at the Philadelphia Textile School. In 1911 he became associated with Dr. William M. Grosvenor and the Grosvenor Laboratories. He had conducted a course in dyeing at New York University since 1935.

In 1920, Dr. Harold was in Paris as a technical advisor to the Reparations Commission and the Department of State. He was the author of many technical papers. He held many textile patents, the latest of which was granted only a week before his death.

He was a charter member of the American Association of Textile Chemists and Colorists and one of the original members of the New York Section. He was an active member of the research committee of this association for over ten years and held the office of councilor at large for three years. Until recently he regularly attended all meetings of the New York Section as well as all the national conventions. He had many friends, both in and out of the textile industry, who will mourn his passing.

His home was at 16 Brewster Avenue, Yonkers, New York. Surviving are his second wife, five sons and four daughters.

• S-K-S DYESTUFF CORP.

Announcement has been made that (effective January 1st, 1940) the Saint-Denis Kuhlmann Saint-Clair Dyestuff Corporation is now the exclusive and direct representative in the United States of the following dyestuff manufacturers: Compagnie Nationale de Matieres Colorantes et Manufactures de Produits Chimiques du Nord Reunies Etablissements Kuhlmann, Societe Anonyme des Matieres Colorantes et Produits Chimiques de Saint-Denis, Societe des Produits Chimiques et Matieres Colorantes de Mulhouse and Compagnie Francais de Produits Chimiques et Matieres Colorantes de Saint-Clair-du-Rhone.

New offices and laboratories are located on the top floor of the Topping Building, 55 Vandam Street (corner of Varick Street), New York City. The telephone number is WOrth 4-5637.

The S-K-S Dyestuff Corporation offers a comprehensive line of dyestuffs including Naphtazols, Fast Salts and Bases for practically every purpose, particularly specialties not produced in this country.

On December 31st, 1939, Fulton Dye & Import Co., Inc., the former agent, ceased to represent the above-mentioned dyestuff manufacturers. All rights in connection with the operation of the Sole Agency, including the exclusive use of all distinctive trade names of the respective manufacturers are taken over by the Saint-Denis Kuhlmann Saint-Clair Dyestuff Corporation.

In the New England States the distribution of products will continue to be handled by the United States Dyestuff Corporation, 76 Batterymarch Street, Boston, Mass. Representation in Canada is handled by the French Dyestuffs Company, Hamilton, Ontario.

• ISOPHORONE

Isophorone, an interesting new industrial chemical, has just been made available in commercial quantities by Carbide and Carbon Chemicals Corporation. It is stated that the solvent action of isophorone on "Vinylite" resins and other plastics makes it suitable for many solvent applications, including those for which methyl amyl ketone has been used; and makes it of great value in the formulation of improved inks, and stencil pastes, as well as the roll-coating finishes.

This industrially new product is a stable, high-boiling cyclic ketone with the formula, $COCH:C(CH_3)CH_2C(CH_3)_2CH_2$. It has a rather mild non-residual odor, and resembles cyclohexanone in a number of respects. While only sightly soluble in water, isophorone is miscible with the usual lacquer solvents.

As with most volatile solvents, adequate ventilation should be maintained to prevent excessive concentration of isophorone. This compound causes definite warning symptoms of irritation of nose and eyes before dangerous concentrations are reached. For safety, sufficient ventilation should be provided to avoid irritation. Isophorone has, however, been handled for several years in research laboratories and in semi-plant tests with roll-coating inks without any evidence of injurious effects.

Isophorone has recently been used as a solvent for resins, and also is suitable for oils, fats, and gums. In addition, its solubility for basic dyes suggests its use in the preparation of dyestuffs, colored lacquers, and printing inks.

Since isophorone contains both a double bond and a ketone group, it is said to be well suited as a starting material in the manufacture of rubber chemicals, corrosion inhibitors, plasticizers, and other industrial chemicals.

Because of its cyclic nature and the presence of a ketone group, isophorone is said to be a powerful solvent for the "Vinylite" resins. When isophorone is used as a solvent for these resins in roller-coating formulations, the latter are said to have unusual and desirable properties. It is claimed that not only do such coatings combine the properties of good appearance and of resistance to the chemical action of water, acids, alkalies, alcohol, and of oil and salt solutions, but special importance must be attached to the toughness of such coatings—which can be subjected to such fabricating operations as drawing and stamping.

• JOINS INTERNATIONAL NICKEL CO.

A. J. Wadhams, vice president and manager of the Development and Research Division of the International Nickel Co., Inc., has announced the addition of Dr. William A. Mudge to the Technical Service Division of the New York office.

For the past 17 years Dr. Mudge has been Superintendent of Research, Superintendent of the Refinery and Works Metallurgist at the company's Huntington, W. Va. Rolling Mill. Before being transferred to the Huntington Plant, Dr. Mudge spent two years at the company's Bayonne, N. J. Refinery, where he joined International Nickel in 1920.

• MOVE WEST COAST OFFICE

The Sandoz Chemical Works, Inc., formerly located at 531 Howard Street, San

Francisco, as of January 2nd, 1940, is now located at 467 East 3rd Street, Los Angeles, Calif. The telephone number is Mutual 1466.

It is stated that with increased warehouse facilities and enlarged offices the company can better serve their customers in the West Coast territory.

• COURSE ON TEXTILE MICROSCOPY

The Division of University Extension of the Massachusetts Department of Education announces an evening textile course to be held at the Massachusetts Institute of Technology, Building 3, 77 Massachusetts Avenue, Cambridge, Massachusetts, in Room 3-305, dealing with the use of the microscope and other optical equipment in the analysis of textile fibers, yarns and fabrics. The course will be given by Professor E. R. Schwarz of the Textile Laboratory, M. I. T., on Wednesday evenings beginning January 24th and continuing for eight consecutive weeks. The lectures begin at 7 P.M. and extend to 9 P.M. and cover by means of stereopticon slides, moving pictures and experiments the types of equipment available, special devices and microscopes suited for micrometry, determination of wool quality, cotton maturity, fiber identification, polarized light, photomicrography, the measure of density, twist, yarn structure, fabric structure and the study of defective materials.

The work is offered in anticipation of a laboratory course to be given under the same auspices later in the year and for the benefit of those interested in lectures and demonstrations covering this particular field. Detailed information is available upon request by writing J. A. Moyer, Director, Division of University Extension, State Education Building, 200 Newbury Street, Boston, Massachusetts.

• PERKIN MEDAL AWARD

The thirty-fourth impression of the Perkin Medal will be presented to Dr. Charles M. A. Stine, Director of Research and Vice President of E. I. du Pont de Nemours & Co., at a joint meeting of the Society of Chemical Industry, American Chemical Society, American Institute of Chemical Engineers, the Electrochemical Society and Societe de Chimie Industrielle, on January 12, 1940. The medal is awarded annually for valuable work in applied chemistry. Dr. Wallace P. Cohoe, Chairman of the American Section, will preside over the meeting. The program will commence with a commemoration of former medallists by Dr. Cohoe. This will be followed by a talk on the life and accomplishments of the medallist by Dr. Harrison E. Howe, Editor of Industrial and Engineering Chemistry. After the presentation of the medal by Professor Marston T. Bogert, Senior Past President of the Society, Dr. Stine will give the medal address entitled "The Rise of the Organic Chemical Industry in the United States." The meeting will be held at 8:00 P.M. at The Chemists' Club, 52 East 41st Street, New York City. A dinner in honor of Dr. Stine will also be held there preceding the meeting, starting at 6:45 P.M.

• GENERAL RELEASES

General Dyestuff Corp., 435 Hudson Street, New York, N. Y., announces release of circulars describing the following products:—

Benzoform Red G—a direct dyestuff which, when aftertreated with formaldehyde and acetic acid, produces on cotton and rayon a full bluish shade of red said to be easily dischargeable and of good fastness to washing. Circular G-175.

Benzoform Violet B B—a direct dyestuff which, when aftertreated with formaldehyde and acetic acid, produces on cotton and rayon bluish shades of violet said to be easily dischargeable and of satisfactory fastness to washing. Circular G-174.

• MEETING, C. A. T. C. C.

"Arbitration Cases" was the subject for discussion at the joint meeting of the Textile Society of Canada (Eastern Division) and the Canadian Association of Textile Colorists & Chemists, Quebec Section, held at the Mount Royal Hotel, Montreal, on Dec. 16th.

This was the first joint meeting of both associations, devoted to "serious business." There had been one previous joint visit to Cornwall, Ont., this Summer.

Whereas there are arbitration boards to settle disputes regarding the origin of defects in textile materials in the U.S.A., Canada so far has no arbitration board. As J. P. Redston, President of the Canadian Association of Textile Colorists and Chemists pointed out, it is often very difficult to settle where, when and why faults occur.

Eight test cases were brought before the arbitration board. Dr. A. C. Goodings of the Ontario Research Foundation acted as chairman of the arbitration board. He was assisted by C. H. Bayley and Dr. P. Larose, both of the National Research Council, Ottawa and by E. Sewell, Magog, Que.

Each case, prepared aforehand and said to be submitted by U. S. mills, was read by J. P. Redston, who guided the proceedings, assisted by H. F. Mills, Honorary President of the Textile Society of Canada, P. Weston-Webb, Secretary-Treasurer of the Textile Society and W. King, Secretary-Treasurer of the C. A. T. C. C.

Illustrated by samples, the cases included such varied faults as Case No. 1: "Breaks in Viscose Pieces"; No. 2, "Bars in Wool and Spun Rayon Pieces"; No. 3, "Stain on Cotton Piece Goods"; No. 4, "Complaint Concerning Colored Stripe in Towel"; No. 5, "Fault in Spun Rayon Crepe"; No. 6, "Dark Streaks in Finished Spool Cotton"; No. 7, "Raw Stock Wool Unevenly Dyed"; No. 8, "Poorly Colored Viscose Satin."

The evidence was submitted to the assembly and the arbitration board gave detailed information.

In debating each case, Mr. Redston allotted each speaker two minutes. The same speaker might speak another two minutes on the same case. Proceedings on each case were limited to fifteen minutes.

After reading the case history, and submitting the samples, speakers from the audience gave their opinions. Dr. A. C. Goodings rendered the final verdict, basing the arbitration board's decision on expert diagnosis of the evidence.

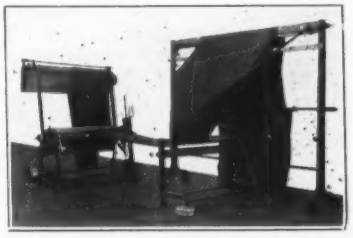
• SOLU-BRIDGE

Industrial Instruments, Inc., 156 Culver Ave., Jersey City, N. J., has recently distributed a leaflet describing the "Solu-Bridge" for testing alkali washing solutions.

The panel scale is calibrated in percentage of sodium hydroxide, so that measurements are easily and directly obtained, without the necessity of referring to complicated graphs or charts. Copies of the leaflet are available upon request.

• TACKING MACHINE

Birch Bros., Inc., 32 Kent St., Somerville, Mass., announce a new high speed tacking machine, complete with new high speed tacking head which operates at 22 to 25 yards per minute; cloth doubler; draw rolls; and folder.



This machine is operating in a number of woolen and worsted mills. The oscillating head with consequent vibration and excessive wear is eliminated.

• OPEN FORUM •

Rules under which this department of the REPORTER is conducted are as follows:

1. Anyone who has a technical problem on which he would like advice may submit it to the Reporter and it will be published in the first available issue.

2. Any reader who feels that he has a solution of the problem may forward his reply to us and if we feel that the reply is suitable it will be published in a succeeding issue.

3. For each such reply published the Reporter will pay a minimum of $2.

4. In case there is more than one answer to the same question, the one covering the subject in the most complete and authentic manner will be published, or if two answers are sufficiently different both will be published. If two answers are considered equally good, the one first received will be given priority.

5. The Reporter will assume no responsibility whatsoever for the accuracy of the answers submitted—it is simply offering a vehicle for the public expression of its readers' opinions.

6. Both the questioner and answerer must send in his complete name and address. When requested we will publish only the initials or other identifying insignia.

47—In recent months we have experienced an entirely new trouble, the very uneven package dyeing of several lots of mercerized yarns, both high grade Combed Peeler and Sak, and both warp and skein mercerized. Satisfactory formulas and methods in the same dyeing machines on the same day act entirely differently on different lots of yarn, therefore methods or water or machines or dyestuffs are not responsible. The dyeing is uneven and the shade is entirely off. On the worst yarn lots there is an actual precipitate from the dyestuff on the outside of the packages. The dyeing is direct, also developed. The worst yarn is also troublesome in skein Vat Dyeing, not in unevenness but in consuming 20 per cent too much dyestuff. The yarn which dyes unevenly with direct dyes in packages can be dyed nearly evenly in skeins with special care. The package dyeing is done in the original wetting out bath and no betterment when the yarn is separately boiled out with scouring or soluble oil. None of the troublesome yarn shows an alkaline reaction from imperfect souring but in some cases a slight souring before dyeing has helped and in other cases no. We notice the most troublesome yarn takes many times as long to wet out in the standard laboratory wetting out test as the satisfactory yarn but in the uneven dyeing we are sure the yarn was properly wet out. In other words the troublesome yarn seems to be to a certain extent waterproofed and to have a precipitating effect on dyestuffs. There are certain chemicals used on Cotton, which are permanently absorbed by cotton and which produce results identical with the above, but the spinners say they use no chemicals whatever and the mercerizers use only caustic and proper souring procedure. What do you say is wrong with the troublesome lots of mercerized yarns and can you suggest remedies? **G.L.**

Answer No. 3—This difficulty can be caused by either one of two things—*water* or *mercerization*.

If this were a water fault, the trouble would show up in *un*mercerized yarn as well as mercerized dyeings.

If this can be attributed to mercerizing, as it no doubt can, it is a fault that cannot be blamed on the mercerizer. It is more likely an inherent quality or tendency of the original grey yarn towards mercerization.

Mild cases of this have been corrected by treating the material with dilute hydrochlorice acid (1 oz. per hundred pounds of liquor) at 180°-200° F. in the presence of some suitable sulfated fatty alcohol derivative that is effective as a detergent in acid baths. Duration of this treatment should be about 15 minutes, preferably not in an iron machine although the presence of pyrophosphates would tend to block off an iron reaction.

For extreme cases, an addition of 8 oz. of sodium chlorite per 100 gallons of liquor is usually quite effective. This is an addition to previous mentioned acid baths.

Stronger baths and longer times will help materially but the above procedure has given remarkable results.

These baths all rinse out very well from the materials.

The apparent fault seems to be that there is a tendency of the mercerizing liquors to react with certain parts of cotton causing differences in the structure of your mercerized product which give you the resulting difficulties.

—B. B.

• CLASSIFIED ADVERTISEMENTS •

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

POSITION WANTED: Dyer, presently employed, wants position in New York City or vicinity. Will consider modest starting salary. Write Box No. 224, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED: Chemist desires position. Twenty-seven years' experience. Fast colors, new finishes, all types laboratory work, yarn, piece goods, cotton or rayon. Excellent health. Write Box No. 212, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED: Yarn dyer, 14 years' experience. Dye rayon, cotton yarns. Vat, naphthol, direct dyes. Double resist dye on acetate rayon (vat). Nine years in own business. Capable taking full charge. Age 35. Excellent health. Willing to travel. Write Box No. 223, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

WANTED: An excellent opportunity is available for the right man to make a connection with a large company to promote and sell a new development to the textile printers. Write giving full details of previous experience. Box 221, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

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